

OCT 1994

**WORKPLAN FOR
PHASE I ROD IMPLEMENTATION
L.E. CARPENTER AND COMPANY
WHARTON, NEW JERSEY**

October 1994

W.O. No.: 06720-019-001

Prepared on behalf of
L.E. CARPENTER AND COMPANY
for the New Jersey Department of Environmental
Protection and Energy

Prepared by:

ROY F. WESTON, INC.
Raritan Plaza I, 4th Floor
Edison, New Jersey 08837

346035



L.E. CARPENTER REMEDIAL ACTION WORK PLAN - PHASE I

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	INTRODUCTION AND SCOPE OF WORK	1-1
2.0	REMEDIAL INVESTIGATION REPORT SUMMARY	2-1
2.1	Introduction and History	2-1
2.2	Geology and Hydrogeology	2-6
2.2.1	Geology	2-6
2.2.2	Hydrogeology	2-7
2.3	Floodplain Delineation and Wetlands Assessment	2-8
2.3.1	Floodplain Delineation	2-8
2.3.2	Wetlands Assessment	2-8
2.4	Site Remedial Activities	2-8
2.5	Findings of the Remedial Investigation	2-10
2.6	Post RI Activities	2-14
2.6.1	Caisson Installation	2-14
2.6.2	PCB Area Delineation	2-14
2.7	Definition of Phase I Areas of Concern	2-16
2.7.1	Inorganic Hot Spots	2-16
2.7.2	DEHP/Organic Hot Spots	2-18
2.7.3	Disposal Area	2-20
2.7.4	PCB Areas Delineation	2-20
3.0	PHASE I SOIL HOT SPOT REMEDIAL ACTION PLAN	3-1
3.1	Inorganic Hot Spots	3-1
3.1.1	Proposed Activity	3-2
3.1.2	Waste Characterization Sampling	3-2
3.1.3	Post-Excavation Analytical Needs	3-3
3.1.4	Dust and Odor Control	3-3
3.1.5	Soil Erosion and Sediment Control	3-3
3.1.6	Restoration	3-4
3.1.7	Disposition of Wastes	3-4
3.2	DEHP/Organic Hot Spots	3-4
3.2.1	Proposed Activity	3-4
3.2.2	Further Delineation	3-5
3.2.3	Post-Excavation Analytical Needs	3-5

L.E. CARPENTER REMEDIAL ACTION WORK PLAN - PHASE I

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.2.4 Dust and Odor Control	3-5
	3.2.5 Soil Erosion and Sediment Control	3-6
	3.2.6 Restoration	3-6
	3.2.7 Disposition of Wastes	3-6
3.3	Disposal Area	3-6
	3.3.1 Proposed Activity	3-7
	3.3.2 Waste Characterization Sampling	3-8
	3.3.3 Post-Excavation Analytical Needs	3-8
	3.3.4 Dust and Odor Control	3-8
	3.3.5 Soil Erosion and Sediment Control	3-9
	3.3.6 Restoration	3-9
	3.3.7 Disposition of Wastes	3-9
3.4	PCB Area	3-9
	3.4.1 Proposed Activity	3-9
	3.4.2 Waste Characterization Sampling	3-10
	3.4.3 Post-Excavation Analytical Needs	3-10
	3.4.4 Dust and Odor Control	3-12
	3.4.5 Soil Erosion and Sediment Control	3-13
	3.4.6 Restoration	3-13
	3.4.7 Disposition of Wastes	3-13
 4.0	 GROUNDWATER REMEDIAL DESIGN DATA ACQUISITION AND WELLFIELD UPGRADE	 4-1
4.1	Aquifer Pumping Test Design	4-1
	4.1.1 Shallow(a) Aquifer Zone Pumping Test	4-2
	4.1.1.1 Monitoring Background Water Level Trends	4-2
	4.1.1.2 Step-Drawdown Test	4-2
	4.1.1.3 Aquifer Test Methodology	4-4
	4.1.1.4 Recovery Test	4-4
	4.1.2 Shallow Aquifer Zone Pumping Test	4-4
	4.1.2.1 RW-2 Redevelopment	4-4
	4.1.2.2 Monitoring Background Water Level Trends	4-5
	4.1.2.3 Step-Drawdown Test	4-5
	4.1.2.4 Aquifer Test Methodology	4-5
	4.1.2.5 Recovery Test	4-5

L.E. CARPENTER REMEDIAL ACTION WORK PLAN - PHASE I

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
4.2	Infiltration/Injection Test Design	4-5
4.2.1	Infiltration Testing	4-7
4.2.1.1	Percolation Tests	4-7
4.2.1.2	Pilot Scale Infiltration Test	4-7
4.2.1.3	Injection Testing	4-8
4.3	Numerical Modelling	4-8
4.4	Monitoring Point Abandonment/Replacement	4-10
4.4.1	Monitoring Point Abandonment	4-10
4.4.2	Monitoring Point Installation/Replacement	4-10
4.5	Groundwater and Floating Product Sampling	4-14
4.5.1	Groundwater Samples	4-14
4.5.2	LNAPL Samples	4-14

LIST OF APPENDICES

Appendices

- Appendix A - Schedule
- Appendix B - Cost Estimate
- Appendix C - Quality Assurance Project Plan
- Appendix D - Health and Safety Plan
- Appendix E - List of Applicable Remedial Standards
- Appendix F - Identification of Required Permits
- Appendix G - Wetland Mitigation Plan
- Appendix H - Soil Erosion and Sediment Control Plan
- Appendix I - Pilot Scale Infiltration Gallery Design

L.E. CARPENTER REMEDIAL ACTION WORK PLAN - PHASE I

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
2-1	Topographic Map	2-2
2-2	General Site Map	2-3
2-3	Approximate Wetlands Location Map	2-9
2-4	Areal Extent of Dissolved VOC in the Shallow Aquifer Zone	2-12
2-5	Areal Extent of Dissolved BN Compounds in the Shallow Aquifer Zone	2-13
2-6	PCB Delineation Samples	2-15
2-7	Hot Spot Location Map	2-17
3-1	PCB Post-Excavation Sampling	3-11

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
4-1	Shallow(a) Aquifer (Well CW-1) Pumping Test Monitoring Locations	4-3
4-2	Shallow Aquifer (Well RW-2) Pumping Test Monitoring Locations	4-6
4-3	Monitoring Points, Injection Test CW-2	4-9
4-4	Monitoring Points Requiring Abandonment	4-11
4-5	Monitoring Points Requiring Abandonment	4-12
4-6	Proposed Monitoring Point Installation/Replacement	4-13
4-7	Proposed Groundwater Sampling Parameters/Rationale	4-15
4-8	Water Quality Indicator Compounds	4-16
4-9	Proposed LNAPL Sampling Points	4-17

SECTION 1.0

INTRODUCTION AND SCOPE OF WORK

L.E. Carpenter and Company (L.E. Carpenter) is pleased to submit this Workplan for Phase I ROD Implementation (Workplan) for the former manufacturing facility located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey. The facility comprises Block 301, Lot 1 and Block 801, Lot 3 on the tax map of the Borough of Wharton. The facility operated as a manufacturing facility for vinyl wall coverings from 1943 through 1987. It is currently utilized as subleased warehouse space and for light manufacturing.

The Remedial Investigation (RI) field effort for the L.E. Carpenter facility was initiated in February 1989. The Draft Report of RI Findings and the Revised Report of RI Findings were submitted to the New Jersey Department of Environmental Protection and Energy (NJDEPE) in November 1989 and June 1990, respectively. A report summarizing the findings of the Supplemental RI sampling effort, was submitted to NJDEPE in November 1990. NJDEPE requested additional investigations in 1991. Various field efforts were completed and reported to NJDEPE as each was completed. A Final Supplemental Remedial Investigation Report was presented in September 1992 which summarized the findings of the investigative efforts undertaken since the Supplemental RI submittal in 1990.

Based on the findings of the RI, the Risk Assessment (RA) and the Feasibility Study (FS), and as presented in the Record of Decision (ROD), remediation is required for the following areas/media:

- inorganic soil hot spots,
- organic soil hot spots,
- PCB contaminated soils,
- former waste disposal area,
- organic contaminated soils in the eastern portion of the site,
- light non-aqueous phase liquid (LNAPL) on the water table, and
- shallow groundwater

The objectives of the remedial action at L.E. Carpenter are to:

- Remediate the possible environmental and human health impacts by reducing contaminant levels, exposure or both in compliance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, also known as Superfund), and the Superfund Amendments and Reauthorization Act of 1986 (SARA), and state-established regulations for the site.

- Enable delisting the site from the National Priorities List (NPL) after completion of remediation.

In order to accomplish these objectives, the remedial action plan requires that several tasks be performed. These include excavation of hot spot soils, in-situ biological treatment of organic contaminated soils located in the eastern portion of the site, active recovery of LNAPL, and extraction of groundwater contaminated with dissolved phase organic contaminants. Extracted groundwater will be treated in an above ground biological reactor. Activities which support the planned remedial action (i.e., design of the groundwater treatment system) will also be performed.

The remedial action has been divided into two phases. The phases are defined as follows:

- Phase I
 - excavation/disposal of hot spot soils
 - groundwater remedial design data collection
- Phase II
 - Stage I groundwater (active product recovery)
 - Stage II groundwater (dissolved phase groundwater remediation)
 - in-situ organic contaminated soils treatment

This Workplan describes the activities which will be undertaken to accomplish Phase I remedial activity. The Workplan consists of four sections and nine appendices.

Section 1.0, Introduction and Scope, provides an overview of the objectives of the scope of work for the remedial action planned. Section 2.0, Remedial Investigation Report Summary, presents a brief history of the facility, the investigations conducted to date and the findings of those investigations. This section also defines the areas of concern that will be addressed during the Phase I remedial action. Section 3.0, Phase I Soil Hot Spot Remedial Action Plan, describes in detail the planned remedial actions for the soil hot spots identified in the ROD. Section 4.0, Groundwater Remedial Design Data Acquisition and Wellfield Upgrade, discusses the aquifer testing and chemical analysis which will be performed to provide data to support the design of the groundwater treatment system.

Appendix A presents the schedule for Phase I field activities. Appendix B provides a budgetary cost estimate for performing Phase I remediation. Appendix C is the Quality Assurance Project Plan (QAPP), which specifies the field and analytical procedures that will be followed to assure that the data quality objectives for the project are met. Appendix D is the Site Health and Safety Plan (HASP). Appendix E lists the soil and groundwater remedial goals, as specified by the ROD. Appendix F identifies the permits which will be required prior to initiating Phase I field activity. Appendix G, the Wetland Mitigation Plan, describes in detail the activities to will be performed to restore wetlands which may be disturbed during excavation of hot spot soils. Appendix H is the Soil Erosion and Sediment Control Plan, which discusses the engineering controls which will be used to control soil erosion and sedimentation associated with the excavations and excavated soils.

SECTION 2.0

REMEDIAL INVESTIGATION REPORT SUMMARY

The Remedial Investigation (RI) field effort for the L.E. Carpenter facility was initiated in February 1989. The Draft Report of RI Findings and the Revised Report of RI Findings were submitted to NJDEPE in November 1989 and June 1990, respectively. A report summarizing the findings of the Supplemental RI sampling effort, was submitted to NJDEPE in November 1990. NJDEPE requested additional investigations in 1991. Various field efforts were completed and reported to NJDEPE as each was completed. A Final Supplemental Remedial Investigation Report was presented in September 1992 which summarized the findings of the investigative efforts undertaken since the Supplemental RI submittal in 1990. This section of the Remedial Action Work Plan will summarize the significant findings of all the RI sampling programs as presented in the referenced reports.

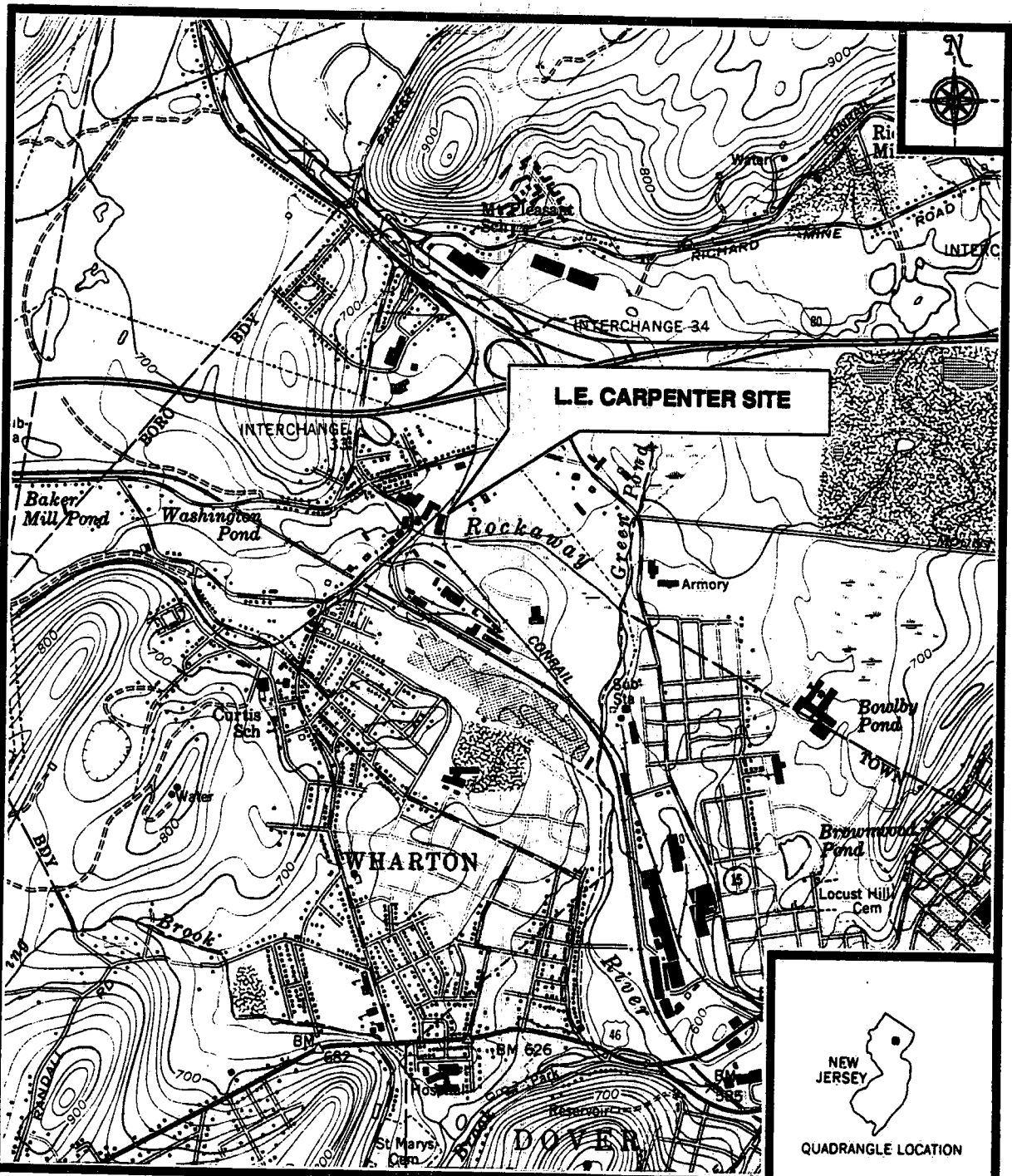
2.1 INTRODUCTION AND HISTORY

The L.E. Carpenter facility is located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey. The location of the facility is shown in Figure 2-1, Topographic Map of the L.E. Carpenter Facility, Wharton, New Jersey. The facility comprises Block 301, Lot 1 and Block 801, Lot 3 on the tax map of the Borough of Wharton.

The L.E. Carpenter facility operated as a manufacturing facility for vinyl wall coverings from 1943 to 1987. It is currently utilized as subleased warehouse space and for light manufacturing.

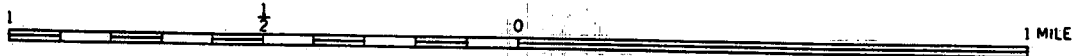
Figure 2-2 depicts the major features of the site and illustrates the immediate environmental setting. The site occupies approximately 14.6 acres northwest of the intersection of the Rockaway River and North Main Street. The site is situated within a mixed commercial/industrial/residential area. The Rockaway River borders the site to the south; a vacant lot (Wharton Enterprises, Inc.) lies to the east; and a large compressed gas facility (Air Products Inc.) borders the site to the northeast. Additional industrial sites are located to the south of the site. The residential portion of the Borough of Wharton is separated from the site by Ross Street, which is located on the northwestern side of the site.

The site is located within the Dover Mining District, which is one of the oldest mining districts in the country. Iron ore was extracted from three mines in the vicinity of the site from the late 1800s to the early 1900s. The Washington Forge Mine and the West Mount Pleasant Mine were located directly on what is currently the L.E. Carpenter property. The Orchard Mine was located on the southern side of the Rockaway River, approximately 200 feet south of the Washington Forge Pond. The Washington Forge and West Mount Pleasant mines operated intermittently between 1868 and 1881. The Orchard Mine was operated intermittently between



SCALE 1:24000

Reference: USGS Dover, NJ Quadrangle

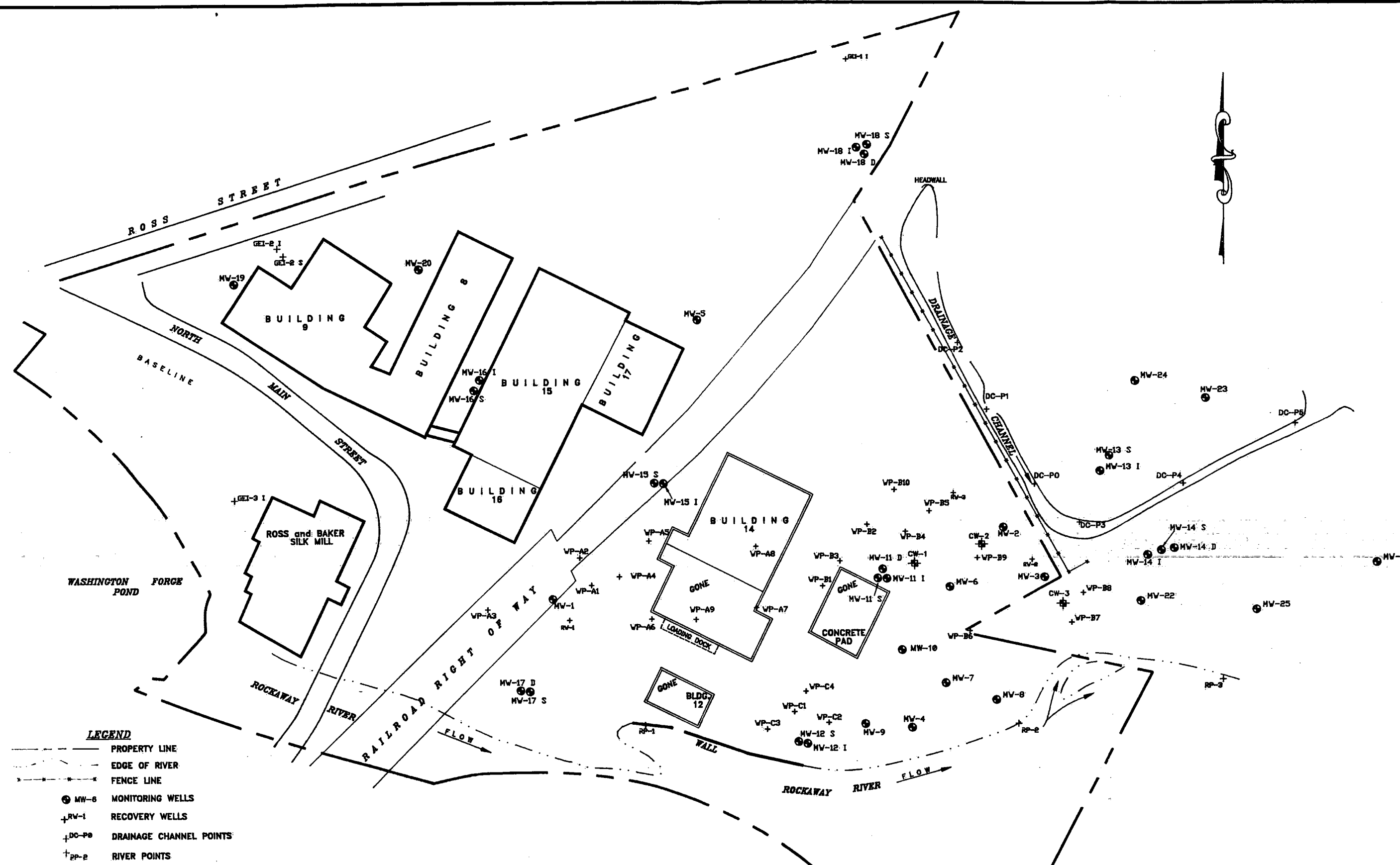


WESTON
MANAGERS DESIGNERS/CONSULTANTS

**L.E. CARPENTER SITE
WHARTON, NJ.**

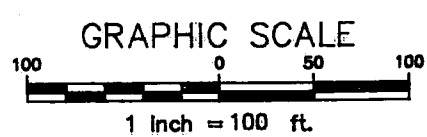
**FIGURE 2-1
TOPOGRAPHIC MAP**

File: LECAR1.DRW



LEGEND

- PROPERTY LINE
- - - EDGE OF RIVER
- x - x - FENCE LINE
- MW-6 MONITORING WELLS
- + RV-1 RECOVERY WELLS
- + DC-P0 DRAINAGE CHANNEL POINTS
- + RP-2 RIVER POINTS
- + GEI-3 I PIEZOMETERS
- + VP-B10 WELL POINTS
- + CW-1 CAISSON WELLS



	PROJECT NAME:	FINAL FEASIBILITY STUDY REPORT	
	WHARTON, NEW JERSEY		
	CLIENT NAME:	L.E. CARPENTER AND COMPANY	
DATE:		10/7/94	FIGURE #: 2-2

1. DATES 10/7/94
 2. 10/7/94
 3. 10/7/94

1850 and 1910. Tailings from the Washington Forge and West Mount Pleasant mines are thought to have been disposed of on site.

The L.E. Carpenter facility was involved in the production of Vicrtex vinyl wall coverings from 1943 to 1987. The production of vinyl wall coverings involves several manufacturing processes which were carried out in the various buildings comprising the L.E. Carpenter facility. Upon delivery to the facility, rolls of virgin cotton cloth were washed (desized) to remove starch and cotton particles. The first step in the manufacturing process is referred to as lamination. Lamination involves the bonding of fabric to the vinyl film using a plastisol adhesive in conjunction with heat and pressure. The fabric/film laminate is then coated with a plastisol compound in order to texturize the material in preparation for printing. The printing process involves the application of decorative print patterns and/or protective topcoat finishes. When printing is completed, the product is inspected and packaged for shipment to the consumer. The facility was originally heated by coal and later converted to #6 fuel oil.

The active production of vinyl wall coverings ceased in 1987. Since that time, the portion of the facility east of the railroad tracks has been inactive. Access is currently restricted to the area east of the railroad track by an eight-foot high chain-link fence. The buildings west of the railroad tracks have been subleased as warehouse space and manufacturing operations.

In response to sampling efforts conducted by the NJDEPE in 1980 and 1981, L.E. Carpenter and NJDEPE entered into an ACO in 1982, which required L.E. Carpenter to:

- Remove the waste sludge from the unlined surface impoundment.
- Define the full extent of chemical compounds floating on the groundwater.
- Decontaminate the groundwater beneath the site as follows:
 - Remove the immiscible chemical compounds from the groundwater.
 - Remove dissolved volatile organic compounds (VOC), including hazardous substances from the groundwater beneath the site.
- Monitor groundwater quality according to the following schedule:
 - Collect samples to be analyzed for specific VOC every two months for a six-month period beginning on or about June 1982 and quarterly thereafter.
 - Take measurements every month to determine groundwater flow direction(s) and the thickness of the free floating organic compounds floating upon the groundwater.

On 24 February 1983, an Addendum (1983 Addendum) was added to the 1982 ACO to clarify its provisions.

Pursuant to the requirements of the 1982 ACO and the 1983 Addendum, L.E. Carpenter took the following actions: in April and May 1982, L.E. Carpenter removed over 4,000 cubic yards of waste from the surface impoundment and thereafter implemented a groundwater quality monitoring program. On 11 May 1984, L.E. Carpenter initiated removal of the immiscible

chemical compounds from the top of the water table beneath the site using a passive recovery system.

On 26 September 1986, an additional ACO was entered into which superseded the 29 January 1982 ACO and the Addendum of 24 February 1983, except all requirements of the Groundwater Decontamination Plan dated 31 October 1983, as approved with conditions by NJDEPE on 26 January 1984 were incorporated. Under the terms of the Amended 26 September 1986 ACO, L.E. Carpenter initiated a RI/FS of its former manufacturing facility in Wharton, New Jersey.

An RI was completed in 1991. Post-RI field activities were conducted in 1993. The RI concluded that contaminants have been or may have been released from a variety of sources at the site. The identified sources include:

- An unlined surface impoundment
- Process discharges
- Raw material storage
- The former tank farm area and other USTs
- On-site disposal
- Historical coal storage and mining operations

Except for the disposal area in the northeastern corner of the site, these sources have since been mitigated. However, secondary sources remain. These include the immiscible product layer, contaminated soil, the former disposal area, and contaminated groundwater.

In general, contaminants have historically moved into the soil and eventually leached (depending on their solubility) to the shallow groundwater. The former tank farm, underground storage tanks, and unlined lagoon have all been removed and disposed of off site. A dissolved organic contaminant plume is present in shallow groundwater, above the clay layer, on site and in the immediate vicinity of the L.E. Carpenter site. The plume is comprised mainly of xylene, ethylbenzene, toluene, and DEHP. The shallow groundwater plume appears to be contained by the Air Products drainage ditch and a variable clay lens on the Wharton Enterprises property. The plume extends approximately 200 feet onto the Wharton Enterprises property. The areal extent of the plume has been established.

Historical migration and seasonal fluctuation of the floating product and contaminated groundwater has contacted and, in turn, contaminated soils near the water table. Isolated areas, mainly associated with building loading docks and raw material storage, contain elevated levels of lead in surface soils.

Contaminant migration has been mitigated and slowed by the implementation of a passive product recovery system which has been operational since 1984 and upgraded in 1991 and 1993.

2.2 GEOLOGY AND HYDROGEOLOGY

2.2.1 Geology

The geology of the L.E. Carpenter site is generally characterized by layers of unconsolidated sediment filling a bedrock trough. The deepest sedimentary unit overlying fractured granitic bedrock is stratified drift. Overlying this unit is a layer of coarse-grained glacial outwash. Above the glacial outwash are finer-grained Quaternary deposits formed by the Rockaway River. The bedrock surface underlying the site has a trough-like morphology. The axis of this bedrock valley trends approximately east-southeast. The observed depth to bedrock ranges from 165 feet at MW-11d to 46 feet at MW-17d near the river. The bedrock is described as medium to coarse-grained granite and exhibits some horizontal to near-vertical fractures.

The deepest unconsolidated unit encountered at the site is the Pre-Late Wisconsin stratified drift deposit (Qplwg). This unit is heterogeneous and consists primarily of gray/brown interbedded and sometimes crossbedded coarse to fine sand. The bedding is generally horizontal, therefore, the hydraulic conductivity of this unit is believed to be greatest in the horizontal direction.

Overlying the stratified drift are Rockaway River outwash deposits (Qr). They were deposited in deep channels cut into the underlying stratified drift. These channels are filled with gray, coarse to fine gravel with abundant cobbles and boulders. This unit is also heterogeneous.

Finer grained river deposits (Qal) were deposited over the outwash deposits. These heterogeneous river deposits vary from dense gray clay to gravelly sand and they occupy the upper 10 to 15 feet BGS over much of the southeastern portion of the site. Several silt/clay layers exist in this unit and the shallowest major clay layer is relatively continuous over much of the site. This upper clay layer is truncated by the Rockaway River to the south and varies in thickness from absent in certain locations to approximately 12 feet in thickness near MW-6 and WP-A7. The upper clay layer forms an important low permeability barrier.

In the vicinity of MW-22, MW-25 and MW-21, the upper clay layer is characterized as gray and very stiff. The unit extends northward from MW-6 and extends to the bottom of the Air Products drainage ditch. Only a very thin (approximately three (3) inches) clay layer was observed at MW-24.

The upper surface of the upper clay layer is undulatory as is typical of river flood deposits reworked by subsequent river meandering. Coarser silty sands, gravels and boulders exist above and below the upper clay layer.

To summarize site geology, the lowermost sedimentary unit above bedrock consists of stratified drift deposits. Higher permeability channel-gravel deposits are incised into these deposits. Rockaway River Quaternary river deposits overlie these deposits. The uppermost clay layer in the heterogeneous Quaternary river deposits is a widespread low-permeability layer.

A more detailed description of the geology at the site may be found in the Final Supplemental Remedial Investigation (FSRI) [WESTON, September 1992].

2.2.2 Hydrogeology

During the remedial investigation, the subsurface hydrogeology of the site was divided into shallow (0 to 30 feet BGS), intermediate (31 to 40 feet BGS) and deep (41 to 170 feet BGS) aquifer zones. Furthermore, in the area of Quaternary river deposits (Qal silt), at 0 to 15 feet BGS, the first groundwater encountered (potentially perched) is referred to as the shallow(a) aquifer zone. This aquifer zone appears to be hydraulically connected to the Air Products drainage ditch. The intermediate and deep aquifer zones are monitored via wells screened solely within the stratified drift deposits (Qplwg). The shallow aquifer zone(s) are monitored via wells screened across the water table within the Rockaway River outwash deposits (Qr) and/or the Rockaway River deposits (Qal). The following are significant hydrogeologic characteristics for the site:

- The Record of Decision (ROD) indicated no further action was necessary for the deep aquifer zone. The vertical flow direction is oriented upward between the deep and the intermediate aquifer zones.
- The ROD indicated no further action was necessary for the intermediate aquifer zone. Within the intermediate aquifer zone, horizontal groundwater flow vectors were oriented west to east. The vertical flow vectors are oriented downward between the shallow and intermediate aquifer zones.
- The shallow aquifer zone(s) features a recharge boundary along the Rockaway River, a local recharge zone centered on MW-11s, and a discharge boundary along Air Products drainage ditch. The overall horizontal flow direction is west to east. It is probable that the upper silt/clay unit may act as a semi-permeable divide between the water table and the deeper groundwater units. The shallow(a) aquifer zone may be defined as that portion of the groundwater above the upper clay/silt unit.

A more detailed discussion of the site specific hydrogeology may be found in the FSRI report (WESTON, 1992).

2.3 FLOODPLAIN DELINEATION AND WETLANDS ASSESSMENT

2.3.1 Floodplain Delineation

The areal extent of the 100- and 500-year flood plains are depicted on Plate 1 (which is included in this Workplan by reference) in the FSRI. The design of the Washington Forge Pond dam is such that blockage of the spillway would result in spillage over the section of the dam north of the water tower along Main Street. In that event, much of the area north of the Central Railroad Right-of-Way (railroad ROW) would lie within both the 100- and 500-year flood plains. This area is labeled Area A on Plate 1. The topographically elevated bed of the railroad ROW would form a barrier prohibiting floodwater from entering the area labeled Area B on Plate 1. Since much of the Area B is topographically elevated compared to the Rockaway River bed, this area would be unaffected by floodwater emanating from the main channel of the river. Therefore, most of Area B lies outside the 100- and 500-year flood plains. Only the eastern perimeter of this area (i.e., the strip along the Wharton Enterprises property boundary and along the Air Products drainage ditch) lies within both the 100- and 500-year flood plains. The Wharton Enterprises portion of the site lies within both the 100- and 500-year flood plains.

2.3.2. Wetlands Assessment

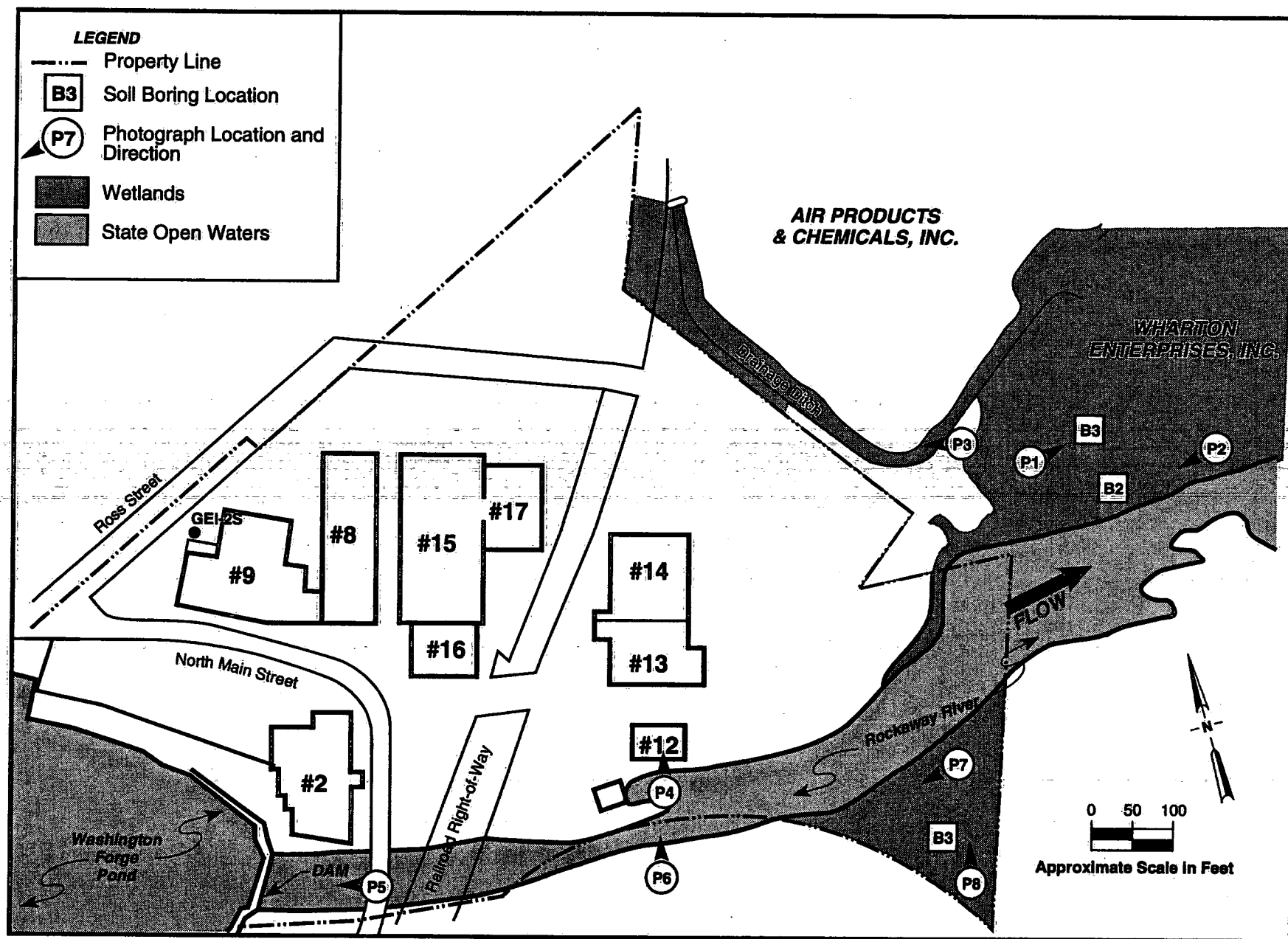
The wetlands assessment, performed by EcolSciences, Inc. of Rockaway, New Jersey, in August 1991, indicated the presence of wetlands at the L.E. Carpenter facility. Approximate locations of wetlands on-site and on adjacent properties are presented in Figure 2-3, duplicated from the Wetlands Assessment Report. On-site wetlands appear to be limited to a narrow strip adjacent to Washington Forge Pond on the southwest border of the property; a strip adjacent to the Rockaway River on the southeast border of the property; and a small area in the vicinity of the former penstock outfall.

A more extensive wetlands area was identified on Air Products property which is associated with the drainage ditch on its western leg. This area extends northwest to the common property boundary of Air Products and L.E. Carpenter. Wetlands were also identified extending from the northeast leg of the drainage ditch through Wharton Enterprises property to the Rockaway River.

The wetlands identified at the L.E. Carpenter facility were classified as being of ordinary resource value. As such, they are subject to a 50 foot transition zone.

2.4 SITE REMEDIAL ACTIVITIES

This subsection of the report will summarize the investigative and remediation activities completed to date as well as provide a chronology of documents previously submitted to the NJDEPE.



947-8262

FIGURE 2-3 APPROXIMATE WETLANDS LOCATION MAP - L.E. CARPENTER AND COMPANY

Several site investigation and remediation activities have been completed. In 1982, L.E.Carpenter removed 4,000 cubic yards of sludge and soil from the former surface impoundment. The starch drying beds were excavated and backfilled. Since May 1984, more than 5,000 gallons of floating product has been recovered from a series of recovery wells located primarily on the eastern side of the site. In 1991, the existing groundwater recovery system was upgraded and three additional recovery wells were installed in order to enhance the removal of the immiscible product. Product recovery rates increased ten-fold with the additional recovery wells and a more efficient skimmer system. Three additional large diameter recovery wells were installed in October 1993. During March 1994, the recovery system was further upgraded by the installation of two additional two-inch skimmer pumps in existing monitoring points, and one four-inch skimmer pumps in each of the three large diameter recovery wells.

In 1989, an extensive asbestos removal was completed in Buildings 12, 13, and 14. All drummed raw materials have been removed from the site. In September 1991, process piping, tanks and appurtenances in Building 13 were decontaminated and disposed of off site and Building 9 interior was decontaminated. In December 1991, Buildings 12 (former boiler house), 13, and 14 were razed.

All underground and inactive aboveground storage tanks were decommissioned and removed from the facility in 1990 and 1991. The underground storage tanks were closed in accordance with procedures established by the NJDEPE Bureau of Underground Storage Tanks (BUST) under an approved tank closure plan (August 1990).

The initial RI was completed in 1989. The SRI was completed in 1990 and several additional focused investigations were completed in 1991. Each investigation resulted in a submittal to NJDEPE. The FSRI report presented and summarized the findings of the investigative efforts completed since the submittal of the SRI. The FSRI was submitted and accepted by NJDEPE in September 1992.

2.5 FINDINGS OF THE REMEDIAL INVESTIGATION

A primary focus of the RI and Supplemental RI was the determination of the extent of contamination related to the former on-site waste impoundment. The RI included a soil gas survey, surface and subsurface soil sampling, sediment sampling, surface water sampling, and groundwater sampling.

A soil gas survey indicated the presence of ethylbenzene, xylene, toluene, and naphtha-related compounds in several areas on site. These data points were used to identify test pit and hand-auger sampling locations.

The soil investigation, consisting of test pit and hand auger sampling, indicated contamination exceeding soil cleanup criteria in the following areas:

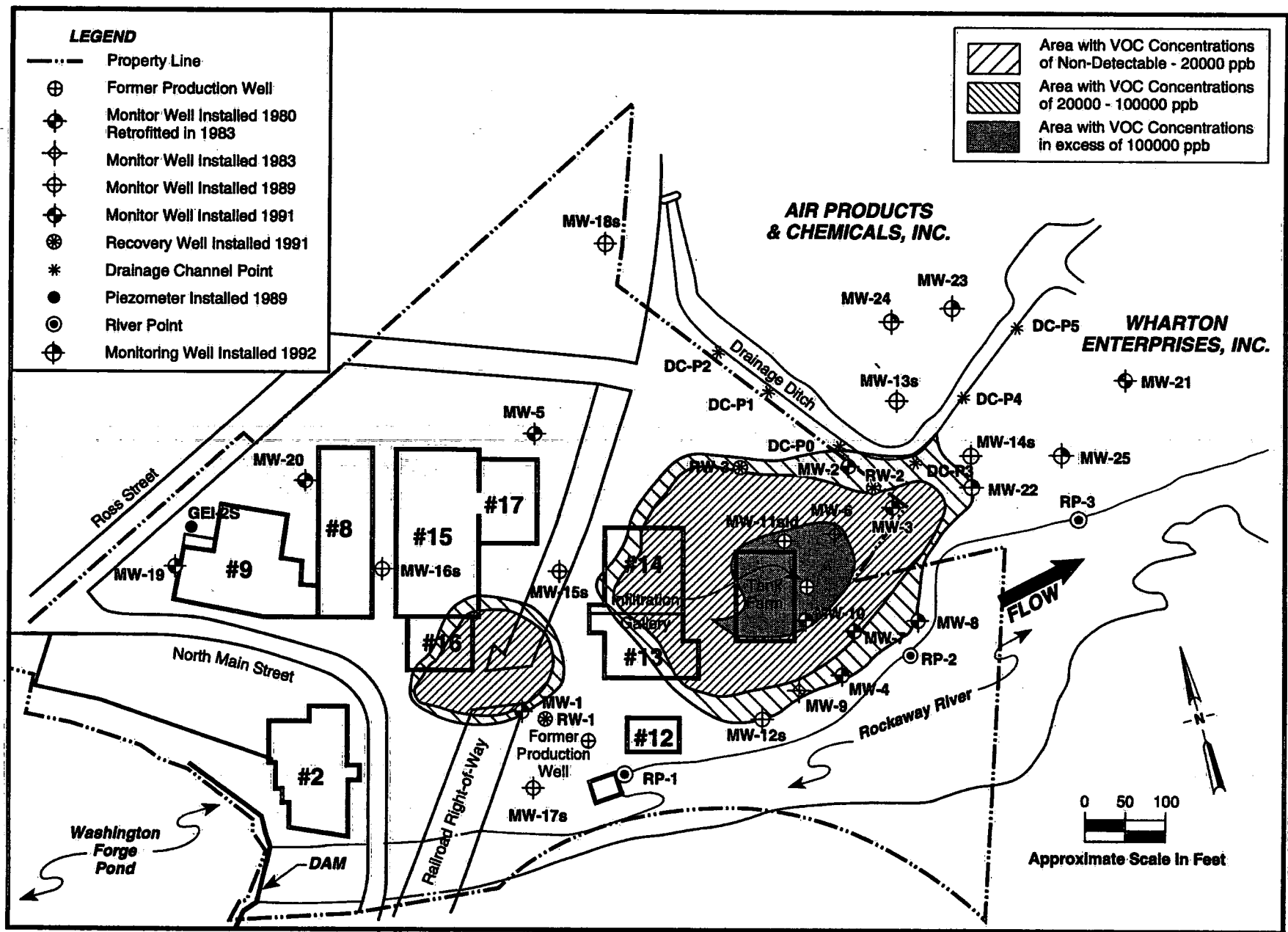
- Volatile organic (VO) and base neutral (BN) compounds in the areas of the former impoundment and tank farm. The VO compounds primarily detected were xylenes and ethylbenzene; the BN compound detected at the highest concentration was DEHP.
- BN compounds (primarily DEHP) in the soil hot spots around underground storage tank pairs E-3 and E-4, and E-5 and E-8. BN compounds were also detected in several isolated surface soil samples associated with loading docks at Building 14, and a floor drain at Building 14.
- Elevated metals (primarily lead and antimony) in several hot spot locations, generally associated with former loading docks.
- An area in which a heterogeneous waste/fill material was visually identified. This area is located near the eastern border of the property and referred to as the former waste disposal area.
- Polychlorinated biphenyls (PCBs) on the Wharton Enterprises Property at concentrations less than the New Jersey hazardous waste limit (50 mg/kg), but greater than soil cleanup criteria. The PCB of concern at the facility is Aroclor 1254.

Groundwater flow patterns and the extent of groundwater contamination are discussed in depth in Section 4.3 of the FSRI (WESTON, 1992). Consistent with historical measurements, shallow groundwater is flowing in a northeasterly direction and is discharging to the drainage ditch. The Rockaway River, adjacent to the site, has consistently acted as a recharge zone.

The areal extent of groundwater contamination is presented in Figures 2-4 and 2-5. Contamination originating from L.E. Carpenter in the shallow groundwater zone is bounded by the Air Products drainage ditch to the north and MW-25 to the east.

Based on the findings of the RI and the Risk Assessment, the ROD indicated no further action is necessary for the following media:

- intermediate groundwater,
- deep groundwater,
- surface water, and
- surface sediment.



1102-8244a 7/15/92

**FIGURE 2-4 AREAL EXTENT OF DISSOLVED VOC IN THE SHALLOW AQUIFER ZONE
L.E. CARPENTER AND COMPANY, WHARTON, NEW JERSEY**

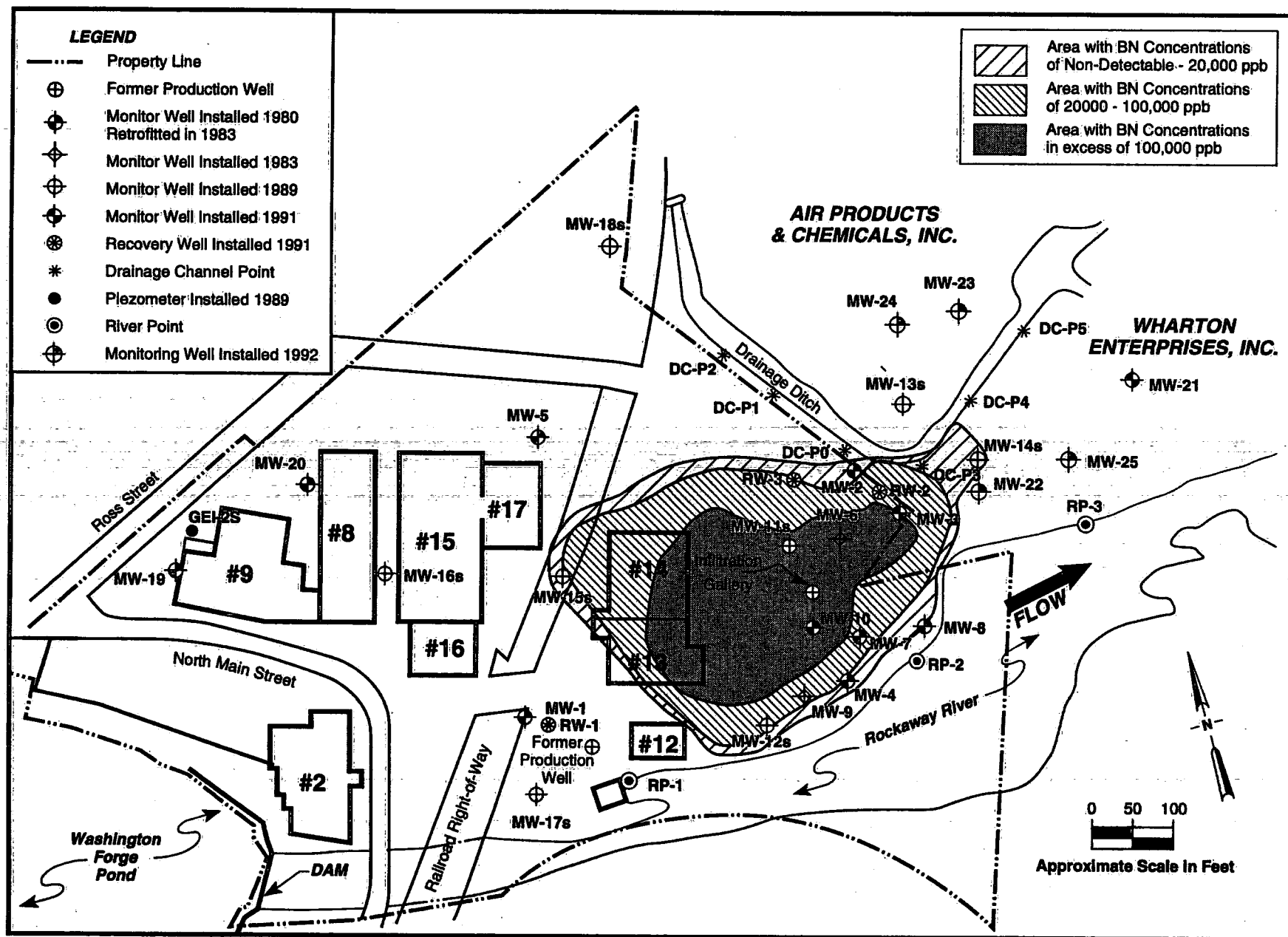


FIGURE 2-5

**AREAL EXTENT OF DISSOLVED BN COMPOUNDS IN THE SHALLOW AQUIFER ZONE
L.E. CARPENTER AND COMPANY, WHARTON, NEW JERSEY**

Remediation is required for the following areas/media:

- inorganic hot spots,
- organic hot spots,
- PCB contaminated soils,
- former waste disposal area,
- organic contaminated soils in the eastern portion of the site,
- light non-aqueous phase liquid on the water table, and
- shallow groundwater.

2.6 POST-RI ACTIVITIES

2.6.1 Caisson Installation

Three large diameter recovery wells were installed on 26 and 27 October 1993. The new recovery wells were installed to enhanced the passive recovery of the light non-aqueous phase liquid (LNAPL) at the site. The specifications to which the wells were installed were described in the work plan submitted to the NJDEPE dated 9 July 1993.

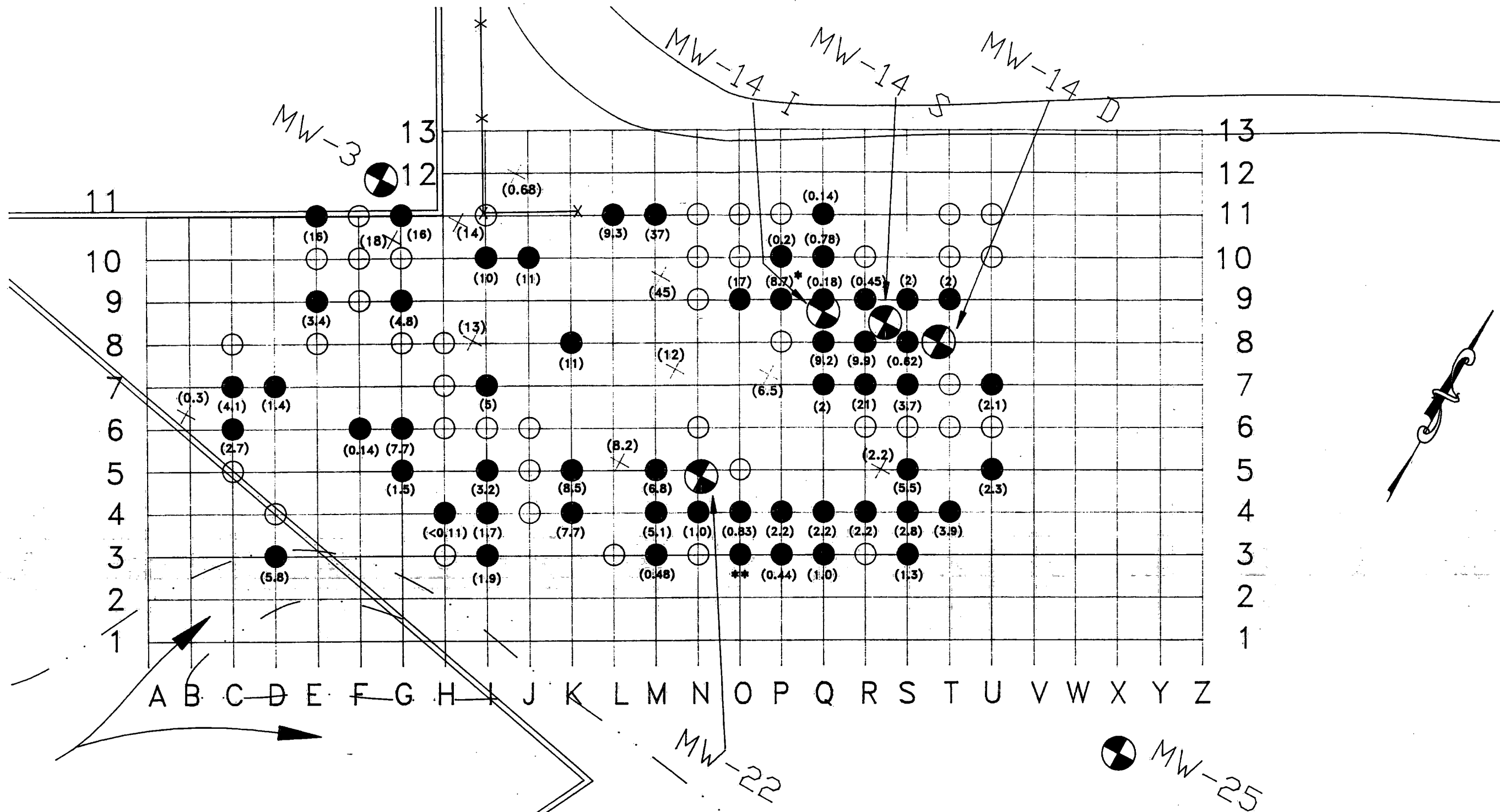
The 24-inch caissons were installed with a track excavator by WESTON personnel under the direct supervision of a New Jersey licensed well driller. The caissons were installed under well permit numbers 25-44147, 25-44148, and 25-44149. The caissons have been designated as CW-1, CW-2, and CW-3, respectively.

On 28 and 29 October 1993, the new caisson wells were developed using overpumping, and pump and surge methods of development. During the week of 28 March 1994, a four-inch skimmer unit was installed in each caisson. Two-inch skimmer units were installed in two additional monitoring points. Passive recovery of LNAPL is continuing at nine (9) locations (MW-3, MW-10, MW-11S, CW-1, CW-2, CW-3, RW-2, RW-3 and WP-B4).

2.6.2 PCB Area Delineation

On 27 and 28 December 1993, soil samples were collected to delineate the locations of surface soils on adjacent properties with PCB concentrations in excess of remedial standards. The sampling plan was designed to allow for a statistical determination of the areal extent of soils with PCB concentrations in excess of the site specific remedial standard.

The locations of the RI samples were field located by triangulation from existing reference points. A 10 foot by 10 foot grid was laid out. Surface soil samples were collected from the 0 - 6 inch interval at grid nodes, as identified in Figure 2-6. Grid nodes lying within the area bounded by the RI soil samples were assumed to be contaminated with PCBs at concentrations which exceed remedial standards.



REVISION # 000 DATE 08/01/94
FILE NAME: 15-1-2-000-000001.DWG B. HIG

	PROJECT NAME:	PRE-REMEDIAL ACTIVITIES	
	CLIENT NAME:	WHARTON, NEW JERSEY	PCB DELINEATION SAMPLES
	L.E. CARPENTER AND COMPANY		DATE: 07/29/94
		FIGURE #:	2-6

All collected samples were extracted upon submittal to the laboratory. A phased approach was taken in determining which samples to analyze. Analysis was initially requested for samples collected on a 20 foot by 20 foot grid. Sample spacing was slightly modified from the plan based on field conditions (for example, insufficient soil for sample collection at a grid node due to surface features). Those results were reviewed in order to determine which additional sample extracts required analysis to further refine extent of soils requiring remediation for PCBs.

A total of 96 soil samples were collected. A total of fifty-five soil samples, two field duplicates and one field blank were analyzed for PCBs by Method 8080, (USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition). The analyses indicated the presence of Aroclor 1254 at concentrations ranging from 0.14 parts per million (ppm) to 45 ppm. No additional PCB aroclors were detected. The concentrations of Aroclor 1254 detected in the samples are presented on Figure 2-6. Review of these results indicate that surface soils with PCB concentrations in excess of remedial goals cover an area approximately 11850 ft².

2.7 DEFINITION OF PHASE I AREAS OF CONCERN

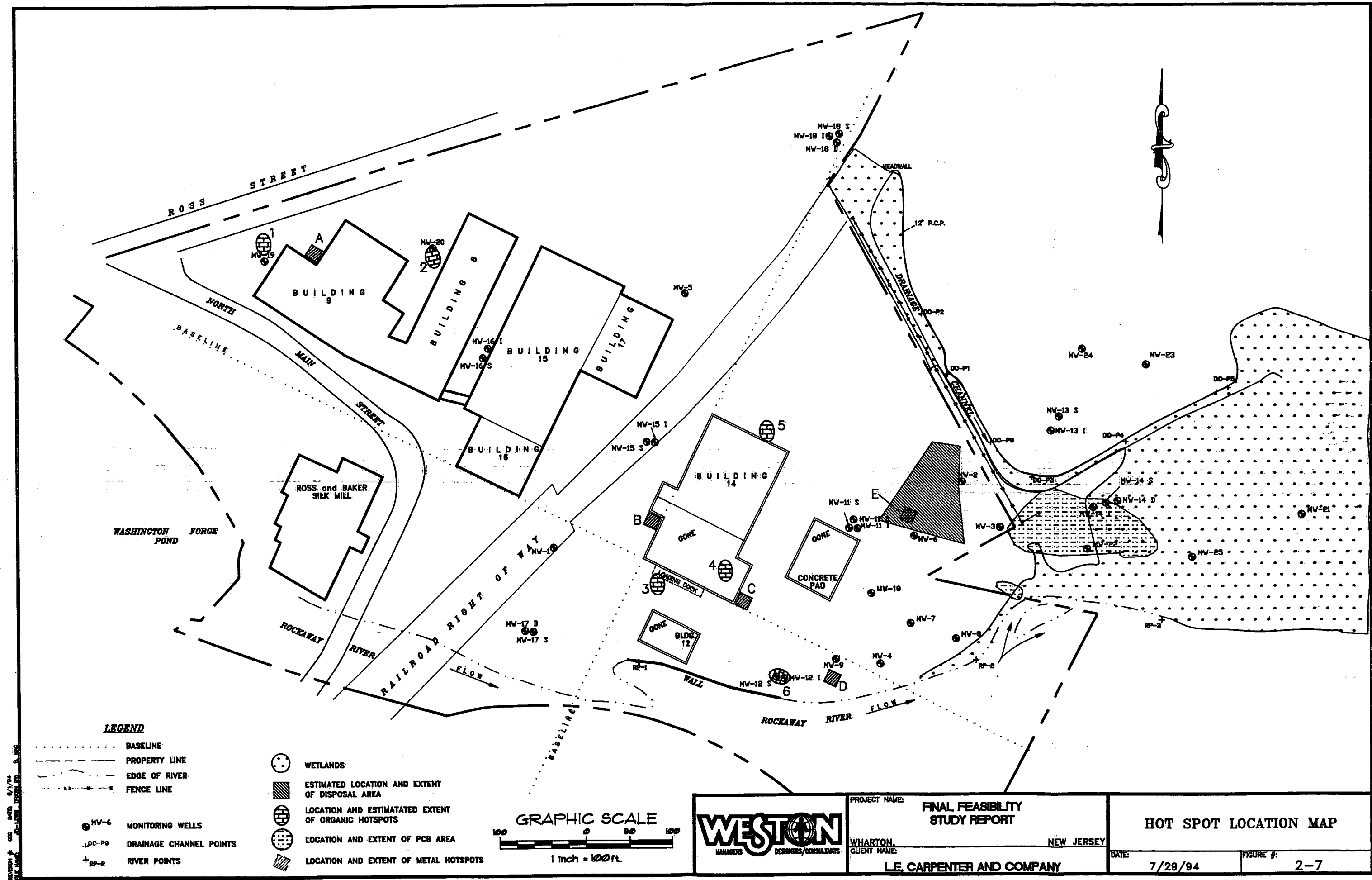
Phase I areas of concern are limited to soil "hot-spots" that were identified during the RI. Post-RI investigations have further delineated the extent of two of the hot spots, namely the former disposal and PCB areas. The following subsections describe the locations, contaminants, and concentrations of the hot spots which will be remediated as part of the Phase I Remedial Action program. The areas described are depicted on Figure 2-7. Remedial goals for the site, as included in the ROD, are presented in Appendix E.

2.7.1 Inorganic Hot Spots

Five locations identified during the RI indicated the presence of inorganic compounds, primarily antimony and lead, at concentrations exceeding the site specific cleanup goals as defined in the ROD.

Hot spot A is located adjacent to the northwestern loading dock of Building 9. Hand auger sample HA-19 was used to identify this hot spot. The sample indicated antimony at a concentration of 828 mg/kg at a depth of 0 - 0.5 feet BGS. Analysis for hand auger sample HA-18, located approximately 20 feet from HA-19, did not detect antimony. This hot spot is estimated to encompass an area of 20 feet by 20 feet by 2 feet depth, for a total volume of 30 yd³. No contaminants other than antimony were detected at concentrations which exceed cleanup criteria.

Hot spot B is located adjacent to the western loading dock of former Building 14. Hand auger sample HA-4 was used to identify this hot spot. The sample indicated lead at a concentration of 2230 mg/kg and chromium at a concentration of 493 mg/kg at a depth of 0 - 0.5 feet BGS. Hand auger sample HA-5, located approximately 20 feet from HA-4, did not detect any contaminant at concentrations which exceeded cleanup criteria. This hot spot is estimated to



encompass and area of 20 feet by 20 feet by 2 feet depth, for a total volume of 30 yd³. No contaminants other than lead were detected at concentrations which exceed cleanup criteria.

Hot spot C is located adjacent to the southern corner of former Building 14. Hand auger sample HA-2, collected during the RI, was used to identify this hot spot. The sample indicated lead at a concentration of 693 mg/kg, antimony at a concentration of 413 mg/kg, DEHP at a concentration of 13000 mg/kg at a depth of 0 - 0.5 feet BGS. This hot spot is estimated to be 30 feet by 30 feet by 2 feet depth, for a total volume of 67 yd³. This hot spot will be remediated under Phase I for metals. Remediation will be considered complete under Phase I when the post-excavation samples indicate inorganic concentrations are within the site specific cleanup goals.

Hot spot D is located in the southern portion of the site, near the Rockaway River and monitoring well MW-9. Test pit sample TP-9A, collected during the RI, was used to identify the hot spot. The sample indicated lead at a concentration of 6530 mg/kg, and antimony at a concentration of 438 mg/kg. Sample TP-9B, collected at a depth of 2 - 2.5 feet BGS indicated lead at a concentration of 338 mg/kg and antimony at a concentration of 89 mg/kg. This hot spot is estimated to encompass an area of 30 feet by 30 feet by 2 feet depth, for a total volume of 67 yd³.

The easternmost hot spot identified (indicated on Figure 2-7 as E) is within the physical confines of the disposal area (described in Section 2.7.3), and therefore is not included in this area of concern, but will be addressed during remediation of the disposal area.

2.7.2 DEHP/Organic Hot Spots

Five locations were identified as organic hot spots. These are defined as areas where soils indicated the presence of organic contaminants (primarily DEHP) which exceed the site specific cleanup criteria. These areas are not contiguous with the organic contaminated soils on site, and are therefore being remediated as hot spots during Phase I.

A sixth hot spot was not identified by soil sampling results, but rather by free phase product observed in monitoring well MW-12s. This area is being included in Phase I remedial action because it is not contiguous with the organic contamination. The remedial action proposed for this area is consistent with remedial activities which will be performed on other hot spots during Phase I remediation.

Hot spot 1 is located to the west of building 9, and is associated with former underground storage tanks (USTs) E-3 and E-4. Four test pit samples were collected during the RI (1989). One of these four samples (TP-63) collected at a depth of 7.5 - 8 feet BGS, indicated the presence of DEHP at a concentration of 430 mg/kg. The concentration of DEHP in the other three samples were less than the cleanup criteria of 100 mg/kg.

Sample TP-63 was collected prior to the tank closures. The tanks were closed in 1991, following the remedial investigation sample collection. The tank excavation extended to a total depth of 5 feet BGS and were filled with certified clean fill. Therefore, the shallowest possible depth of contaminated soil in this area is 5 feet BGS. Hot spot 1 is estimated to encompass an area of 15 feet by 15 feet by 5 feet thick, for a total volume of 42 yd³.

Hot spot 2 is located to the west of Building 8, and is associated with former USTs E-5 and E-8. Eight test pit samples were collected during the RI. Six of the eight samples indicated the presence of DEHP at concentrations which exceed the cleanup criteria. The highest concentration detected in these samples was 6200 mg/kg. These samples were collected prior to the tank closures, at depths ranging from 4.5 - 5.5 feet BGS.

Tanks E-5 and E-8 were closed in 1991, following the remedial investigation sample collection. The tank excavation extended to a total depth ranging from 8 feet BGS to 10 feet BGS, deeper than the RI soil samples. The post closure soil samples, collected from the bottom of the excavation, were not analyzed for base neutral extractable compounds. The tank excavations were filled with certified clean fill. It is likely that hot spot 2 was remediated during tank closure activities. Soil samples will be collected and analyzed for DEHP prior to initiating excavation activities at this hot spot, to determine if contamination remains. If remediation is warranted, this hot spot, as originally defined in the RI, is estimated to encompass an area of 50 feet by 50 feet by 5 feet thick, for a total volume of 463 yd³.

Hot spot 3 is located adjacent to the southern loading dock of former Building 14. Hand auger sample HA-6, collected during the RI, was used to identify the hot spot. The sample indicated DEHP at a concentration of 230 mg/kg at a depth of 0 - 0.5 feet BGS. Hand auger sample HA-7, located approximately 20 feet from HA-6, did not detect any contaminant at concentrations which exceeded cleanup criteria. This hot spot is estimated to encompass an area of 20 feet by 20 feet by 2 feet depth, for a total volume of 30 yd³. No contaminants other than DEHP were detected at concentrations which exceed cleanup criteria.

Hot spot 4 is associated with a floor drain in former Building 14. Hand auger sample HA-1, collected during the RI, was used to identify the hot spot. The sample indicated DEHP at a concentration of 15000 mg/kg at a depth of 0 - 0.5 feet BGS. This hot spot is estimated to encompass an area of 20 feet by 20 feet by 2 feet depth, for a total volume of 30 yd³. No contaminants other than DEHP were detected at concentrations which exceed cleanup criteria.

Hot spot 5 is located on the northern side of former Building 14, adjacent to the former floor drain discharge point. Hand auger sample HA-3, collected during the RI, was used to identify the hot spot. The sample indicated DEHP at a concentration of 160 mg/kg at a depth of 0 - 0.5 feet BGS. This hot spot is estimated to encompass an area of 20 feet by 20 feet by 2 feet depth, for a total volume of 30 yd³. No contaminants other than DEHP were detected at concentrations which exceed cleanup criteria.

Hot spot 6 is associated with monitoring well MW-12. This location has been included due to the free product identified in MW-12. The areal extent of the product has been defined by the location of the A-series well points, and is estimated as 50 feet by 30 feet by 6 feet thickness, for a total volume of 330 yd³. The contaminants have been tentatively identified (using fingerprint analysis) as predominantly xylenes, and similar in composition to the floating product identified under the central eastern portion of the site.

2.7.3 Disposal Area

The disposal area is located on the eastern portion of the property. The areal extent of this area was determined using a series of test trenches, installed on site in January 1992. The material encountered during the test trenching operation was described as a heterogeneous mixture of a grayish-white chalky fill material, dried sludge, drum debris and metal, and pieces of wood. Analyses of two samples collected from the fill material indicate the presence of ethylbenzene, xylenes, methylene chloride, DEHP, antimony, and lead at concentrations in excess of cleanup criteria. The areal extent of the hot spot will be visually refined during excavation, and is currently estimated as 8500 ft² by 1 foot thickness, for a total volume of 300 yd³.

2.7.4 PCB Contaminated Soils

An area of soils contaminated with Aroclor 1254 was identified during the RI. The extent of this area was further defined during the delineation sampling conducted in December 1993. This area is depicted on Figures 2-6 and 2-7. Analyses of 64 surface soil (0 - 0.5 feet BGS) samples have indicated the presence of Aroclor 1254 at concentrations up to 45 mg/kg. Nine of the samples were analyzed during the RI, with the remaining 55 samples being analyzed under the delineation program. The delineation program has indicated an area of 11,850 ft² of surface soils with PCBs in excess of the cleanup criteria of 2 mg/kg. Assuming a depth of 2 feet, the total volume of soils associated with this hot spot is 880 yd³.

SECTION 3.0

PHASE I SOIL HOT SPOT REMEDIAL ACTION PLAN

The following sections describe in detail the planned remedial actions for the soil hot spots identified in the ROD. A discussion of the following items will be included in the description of the remedial action planned for each hot spot:

- proposed activity,
- further delineation,
- post-excavation sample analysis,
- dust and odor control,
- soil erosion and sediment control,
- restoration, and
- disposition of wastes.

Site mobilization activities for the various tasks outlined in the Phase I Remedial Action will include the location and markout of the underground utilities at the site (i.e.: gas, electric, telephone, cable television, water and sewer). A request for the mark-out of each utility at all of the site excavation areas will be placed by telephone to its respective supplier if it is not covered by the local one-call number (1-800-272-1000). Confirmation numbers will be obtained from each utility prior to excavation or other intrusive sub-surface activities. The standard color codes for the subsurface utilities will be incorporated into the site Health and Safety Plan (through the daily briefings), and will be familiar to all site individuals involved in intrusive activities.

Other pre-mobilization activities will include the procurement of the necessary personal protective equipment, air monitoring equipment, sampling equipment, excavation machinery, vapor suppressive equipment, and disposal containers.

Prior to excavation in each area, the field crew will set up the work (hot) zone and the contamination reduction/support zone. All site personnel entering the work zone will do so through the contamination reduction zone. Upon departing the work zone, personnel will exit through the contamination reduction zone, utilizing the field decontamination procedure appropriate for the level of personal protection used. Field decontamination procedures are included in the Health and Safety Plan.

3.1 INORGANIC HOT SPOTS

As mentioned in Section 2.7.1, five inorganic hot spots were identified during the RI. The remedial strategy for these soils involves excavation and removal. Hot spots A, B, C, and D are associated with shallow (0 - 2 feet BGS) soils. Hot spot E is associated with the Disposal Area, and will be remediated under that Operable Unit.

3.1.1 Proposed Activity:

Remediation of the inorganic hot spots will be performed as follows:

- Perform waste characterization sampling.
- Excavate surface soil in the identified hot spots. Begin excavation at location of sample which identified the hot spot, and expand excavation radially outward. Excavate soil approximately twelve inch lifts.
- Use an X-ray fluorescence (XRF) meter to screen soil remaining in the excavation. If field screening results indicate contaminants are still present at concentrations greater than the cleanup criteria specified in the ROD, continue excavation. If field screening results indicate compliance with the cleanup criteria, do not excavate any further. (Note: maximum depth of excavation will be the water table).
- Collect post-excavation samples for laboratory (confirmatory) analysis.
- Backfill excavations with certified clean fill.
- Dispose of bulked soil in accordance with the waste characterization analyses. Stabilization and landfilling is anticipated.

3.1.2 Waste Characterization Sampling

Prior to excavation, waste disposal characterization samples will be collected. It is anticipated that hot spots A, B, and D will be bulked together for disposal. Hot spot C will be disposed of as a separate waste stream due to the organic constituents.

Based on the estimated volumes of soil in the various hot spots, and using the frequency specified in Appendix I to the NJDEP Waste Classification Request Form (HWM-009), an estimated six grab soil samples will be collected from hot spots A, B, and D (two grab samples from each). The six grab samples will be composited at the lab on an equal weight basis into a total of two composite samples. The samples will be analyzed for disposal characteristics, as described in the Quality Assurance Project Plan (QAPP). Three grab samples will be collected from hot spot C. These samples will be composite by the lab and analyzed for disposal characteristics.

Sample collection will be performed using surface soil sampling techniques, as described in the QAPP.

3.1.3 Post-Excavation Analytical Needs:

Post-excavation sampling will be performed as specified in the Technical Requirements for Site Remediation (N.J.A.C. 7:26E-6.4(a)2.). One sample will be collected from the top of each excavation sidewall for every 30 linear feet of sidewall, and one sample will be collected from the excavation bottom for every 900 square feet of excavation. Post-excavation analyses will be performed for the following analytes:

Hot spot A - antimony,
Hot spot B - lead,
Hot spot C - antimony and lead, and
Hot spot D - antimony and lead.

3.1.4 Dust and Odor Control:

A Mini-RAM particulate monitor will be used onsite to monitor particulate levels. A site specific action level for metals-contaminated soil has been set at 2.3 milligrams per cubic meter (mg/m^3). This level takes into account the maximum concentration of inorganic contaminants in the soil samples. Engineering controls (i.e.: personal protective equipment (PPE), potable water mist) will be used to minimize personnel contact with dust.

The hazards associated with the excavation of soils containing organics (i.e.: hot spot C) will be minimized through the use of a vapor suppressant foam, if necessary. In addition, portable instrumentation will be utilized to monitor the work area for volatile organic vapors. Action levels for engineering control procedures (such as upgrading PPE or applying vapor suppressant foam) are specified in the Health and Safety Plan (HASP).

Wind speed and direction will be determined and recorded in the field logbook. Periodic air monitoring will be performed at the site perimeter downwind of intrusive activities. The equipment used for the perimeter monitoring will be that specified in the HASP for the hot spot being excavated. If sustained elevated levels of organic vapors or dust are detected at the site perimeter, engineering controls (i.e., vapor suppressant foam, water mist spray, etc.) will be applied to the excavation and/or stockpiled soils to reduce the generation of airborne contaminants. If these measures do not adequately lower the concentrations of airborne contaminants, the excavation will be closed and site activities (with respect to that hotspot) will cease.

3.1.5 Soil Erosion and Sediment Control:

Each inorganic hot spot is limited in size. The excavations and stockpiled materials will not likely produce significant volumes of sediment. Excavated soils will be placed directly into containers (rolloffs, dump trailers, etc.) to minimize the potential for sedimentation. Any residual sedimentation and erosion will be controlled with engineering controls such as silt fence,

haybales, and/or polyethylene sheeting. All engineering controls will be applied in accordance with the Soil Erosion and Sediment Control Plan, presented in Appendix H.

3.1.6 Restoration:

The excavation will be backfilled with clean fill. The hotspots will be restored to their original condition, with respect to topography, hydrology, and vegetation to the maximum extent feasible. L.E. Carpenter will either pave or revegetate the surface of the filled hot spots, based on field conditions.

3.1.7 Disposition of Wastes:

All soils will be disposed off site, in accordance with all applicable laws and regulations. Bulk, excavated soil will be disposed of in a manner consistent with the results of the waste characterization analyses.

3.2 DEHP/ORGANIC HOT SPOTS

As mentioned in Section 2.7.2, five organic hot spots were identified during the RI. A sixth is located in the immediate vicinity of monitoring well MW-12s. Hot spots 1 and 2 are associated with former USTs. Hot spot 3 is associated with the southern loading dock of former Building 14. Hot spot 4 is associated with a floor drain in former Building 14, while Hot spot 5 is located adjacent to a floor drain discharge point.

3.2.1 Proposed Activity:

Remediation of the organic hot spots will be performed as follows:

- Perform confirmation sampling (Hot Spot 2).
- Excavate each identified hot spots. Begin excavation at location of sample which identified hot spot, and expand excavation radially outward.
- Use field monitoring instruments capable of detecting organic contaminant of concern for each hot spot to perform headspace screening of soil remaining in the excavation. If field screening results indicate contaminants are still present, continue excavation. If field screening results indicate contaminants are no longer present, perform post-excavation confirmatory sampling. (Note: maximum depth of excavation will be the water table.)
- Soils exhibiting the presence of free product (i.e., Hot Spot 6) will be segregated from the homogenous soils, stockpiled, sampled, and evaluated for offsite treatment and disposal at an approved disposal facility.

- Homogenous soils will be placed in the excavation created during remediation of the disposal area. These soils will be remediated insitu by soil flushing and biodegradation during the Stage II groundwater remedial action.
- Collect post-excavation samples for laboratory (confirmatory) analysis. Confirmatory analysis will be performed for the contaminant of concern for that hot spot only.
- After receiving confirmatory analytical results, backfill excavations with certified clean fill. Restore sites to their pre-existing condition.

3.2.2 Further Delineation:

Confirmation sampling will be performed for Hot Spot 2. The soil samples that indicated concentrations of semi-volatile compounds were collected prior to the closure of USTs E-5 and E-8. Soil borings will be performed in the immediate vicinity of test pit samples TP-55 through TP-62. Soil samples will be collected from the 4.5 - 5.5 feet BGS interval to determine if BN compounds detected during the RI (DEHP, butyl benzyl phthalate) were remediated during the tank closures.

3.2.3 Post-Excavation Analytical Needs

Post-excavation sampling will be performed as specified in the Technical Requirements for Site Remediation (N.J.A.C. 7:26E-6.4(a)2.). For surficial hot spots (3, 4 and 5), one sample will be collected from the top of each sidewall for every 30 linear feet of sidewall and one sample will be collected from the excavation bottom for every 900 square feet of excavation. For subsurface hot spots (1, 6 and, if necessary, 2), one sample will be collected from the bottom of each sidewall for every 30 linear feet of sidewall and one sample will be collected from the excavation bottom for every 900 square feet of excavation. Post-excavation analyses will be performed for the following analytes:

Hot spot 1 - DEHP,
Hot spot 2 (if remediation is required) - DEHP, butyl benzyl phthalate,
Hot spot 3 - DEHP,
Hot spot 4 - DEHP,
Hot spot 5 - DEHP, and
Hot spot 6 - xylenes.

3.2.4 Dust and Odor Control:

The hazards associated with the excavation of soils containing organics will be minimized through the use of a vapor suppressant foam, if necessary. The foam will be used to control both nuisance odors and the risk of fire. Portable instrumentation will be utilized to monitor the work area for volatile organic vapors. Action levels for engineering control procedures (such

as upgrading PPE or applying vapor suppressant foam) are specified in the Health and Safety Plan (HASP).

Wind speed and direction will be determined and recorded in the field logbook. Periodic air monitoring will be performed at the site perimeter downwind of intrusive activities. The equipment used for the perimeter monitoring will be that specified in the HASP for the hot spot being excavated. If sustained elevated levels of organic vapors or dust are detected at the site perimeter, engineering controls (i.e., vapor suppressant foam, water mist spray, etc.) will be applied to the excavation and/or stockpiled soils to reduce the generation of airborne contaminants. If these measures do not adequately lower the concentrations of airborne contaminants, the excavation will be closed and site activities (with respect to that hotspot) will cease.

3.2.5 Soil Erosion and Sediment Control:

Each organic hot spot is limited in size. The excavations and stockpiled materials will not likely produce significant volumes of sediment. Excavated soils contaminated with free product will be placed directly into containers to minimize the potential for sedimentation and runoff. Homogenous soils will be placed directly into the disposal area excavation. Any residual sedimentation and erosion will be controlled with engineering controls such as silt fence, haybales, and/or polyethylene sheeting. All engineering controls will be applied in accordance with the Soil Erosion and Sediment Control Plan, presented in Appendix H.

3.2.6 Restoration:

The organic hot spots will be restored to their original condition with respect to topography, hydrology, and vegetation to the maximum extent feasible. The excavations will be backfilled with certified clean fill. The fill shall have a permeability equal or less than that of loam, at a minimum. L.E. Carpenter will either pave or revegetate the surface of the filled hot spots, based on field conditions.

3.2.7 Disposition of Wastes:

The majority of soil excavated from the organic hot spots will be consolidated within the disposal area excavation. This soil will be remediated by insitu soil flushing and biodegradation. Soils contaminated with free product will be stockpiled, sampled for waste characteristics, and disposed off site in accordance with the results of the waste characterization sampling.

3.3 DISPOSAL AREA

The disposal area was identified during the upgrade to the passive product recovery system. A series of test trenches were installed in January 1992 to define the lateral extent of this hot spot.

3.3.1 Proposed Activity:

Remediation of the disposal area will be performed as follows:

- The field crew will establish the areal limits of the disposal area excavation based on the findings of the test trenching operations conducted on 29 January 1992.
- Remove clean overburden soil and stockpile in accordance with the Soil Erosion and Sediment Control Plan.
- Perform perimeter air sampling with direct reading instruments. Apply vapor suppressive foam as required, based on air monitoring results.
- Visually identify the waste (sludge-like material of various colors, chalky white fill material, and debris). Excavate, separate, and place the waste in transportation containers (drums, boxes, rollofs, or dump trailers) The containers used will depend on the waste characterization sampling results and disposal facility requirements.
- Use XRF meter to screen underlying soil for lead and antimony. If field screening results indicate contaminants are still present at concentrations greater than the cleanup criteria specified in the ROD, continue excavation. If field screening results indicate compliance with the cleanup criteria, do not excavate any further (Note: maximum depth of additional soil excavation will be the water table).
- Collect post-excavation samples for laboratory analysis for lead and antimony.
- Perform waste characterization sampling.
- Dispose of the waste off site, according to the results of the waste classification analytical results.
- The excavation will remain open for a maximum of two weeks, to allow light, non-aqueous phase liquid (if encountered) to be skimmed off.
- Backfill the excavation with soil excavated from the organic hot spots.
- Install a pilot scale infiltration gallery above the consolidated hot spot soils. Cover the infiltration gallery with overburden soils that were excavated at the beginning of the disposal area activity. Design details of the pilot scale system are presented in Appendix I.
- Replace caisson well CW-2 if it was disturbed during excavation. Reseed the replaced overburden in season to reduce the potential for future erosion.

3.3.2 Waste Characterization Sampling:

Waste characterization samples will be collected from the stockpiled disposal area waste. Depending upon the depth of the sample, trowels or bucket augers will be used to collect grab samples from the pile. One grab sample will be collected for each 20 cubic yards of stockpiled waste. Up to five adjacent grab samples will be composited at the laboratory to make an area composite. The area composite samples will be analyzed for the waste classification parameters presented in the QAPP. The analytical results will be used to complete waste profile sheets, which will be submitted to disposal facilities for their approval. Upon determination of the treatment facility and disposal method, the waste will be package and shipped off-site for final disposition.

3.3.3 Post-Excavation Analytical Needs:

Post-excavation sampling for organic constituents is not required for this hot spot, since it is in the area in which bioremediation of soils will occur during Phase II remediation. Post-excavation soil sampling will be limited to the parameters of antimony and lead.

The excavation is estimated as being 8,500 square feet in area, with a perimeter of 360 feet. Per the Technical Requirements for Site Remediation (N.J.A.C. 7:26E-6.4(a)2.iii), a reduced sampling frequency will be performed. One perimeter sample will be collected from the bottom of the sidewall for every 60 feet (6 samples), and one sample will be collected from the bottom of the excavation for every 1,700 square feet (5 samples). This sampling frequency is considered adequate since the waste in the disposal area is easily distinguishable from the surrounding soils by visual observation.

3.3.4 Dust and Odor Control:

A vapor suppressive foam generator will be set up in the support zone adjacent to the work area. Vapor suppressive foam will be applied to the excavation as necessary to minimize the potential migration of airborne contaminants outside the work zone, as specified in the HASP. The foam will be used to control both nuisance odors and the risk of fire. Portable, real-time instruments will be used to monitor the work area for volatile organic vapors. A Foxboro Organic Vapor Analyzer (OVA) or equivalent will be used to monitor ambient levels of organic vapors. If sustained readings of 30 parts per million (methane equivalent) are detected at the work area perimeter, the suppressant foam will be applied. Determination of further action will be based on consistency of readings and wind direction.

Wind speed and direction will be determined and recorded in the field logbook. Periodic air monitoring will be performed at the site perimeter downwind of intrusive activities. The equipment used for the perimeter monitoring will be that specified in the HASP for the Disposal Area. If sustained elevated levels of organic vapors or dust are detected at the site perimeter, engineering controls (i.e., vapor suppressant foam, water mist spray, etc.) will be applied to the excavation and/or stockpiled materials to reduce the generation of airborne contaminants. If

these measures do not adequately lower the concentrations of airborne contaminants, the excavation will be closed and Disposal Area site activities will cease.

3.3.5 Soil Erosion and Sediment Control:

Stockpiled wastes will be placed on and covered by polyethylene sheeting. Engineering controls will be used, as specified in the Soil Erosion and Sediment Control Plan (Appendix H), to prevent residual erosion and sedimentation.

3.3.6 Restoration:

This hot spot is located within the area of insitu soils treatment which will occur during groundwater remediation. As a result, the surface may be reworked during groundwater extraction/recharge system installation. Restoration at this site, therefore, will be minimal. Reseeding, in season, will be performed to reduce soil erosion and sedimentation of the excavated and backfilled soil. Final restoration of the site to pre-remediation conditions will occur after the site soils and groundwater remediation is completed.

3.3.7 Disposition of Wastes:

All wastes excavated from the disposal area will be shipped off site for disposal. Disposal will be performed in a manner consistent with the results of the waste characteristic sampling.

3.4 PCB AREA

The PCB contaminated surface soils are located on the eastern portion of the site. The area of concern is a wetland. Remedial action will not be performed until a wetlands permit has been obtained and the Soil Erosion and Sediment Control Plan has been approved.

3.4.1 Proposed Activity:

Remediation of this area will be performed as follows:

- Begin excavating soils in shallow (approximately 12 inch) lifts. Stockpile soil in accordance with Soil Erosion and Sediment Control Plan.
- Use EnSys test kits to perform post-excavation field screening.
- If test kits indicate PCB concentrations in soils are less than cleanup criteria, collect post-excavation confirmation samples. If test kits indicate PCB concentrations in excess of 2 mg/kg remain, excavate an additional lift in that area.
- Continue field screening and excavation until soil remediation goal is met, or the top two feet of soil has been excavated.

- Collect post-excavation samples for laboratory analysis for PCB and DEHP.
- Perform waste characterization analysis. Obtain approval from a disposal facility based on waste characterization analyses.
- Dispose excavated soil off site according to results of waste characterization analyses.
- Restore site according to the Wetlands Restoration Plan.

3.4.2 Waste Characterization Sampling:

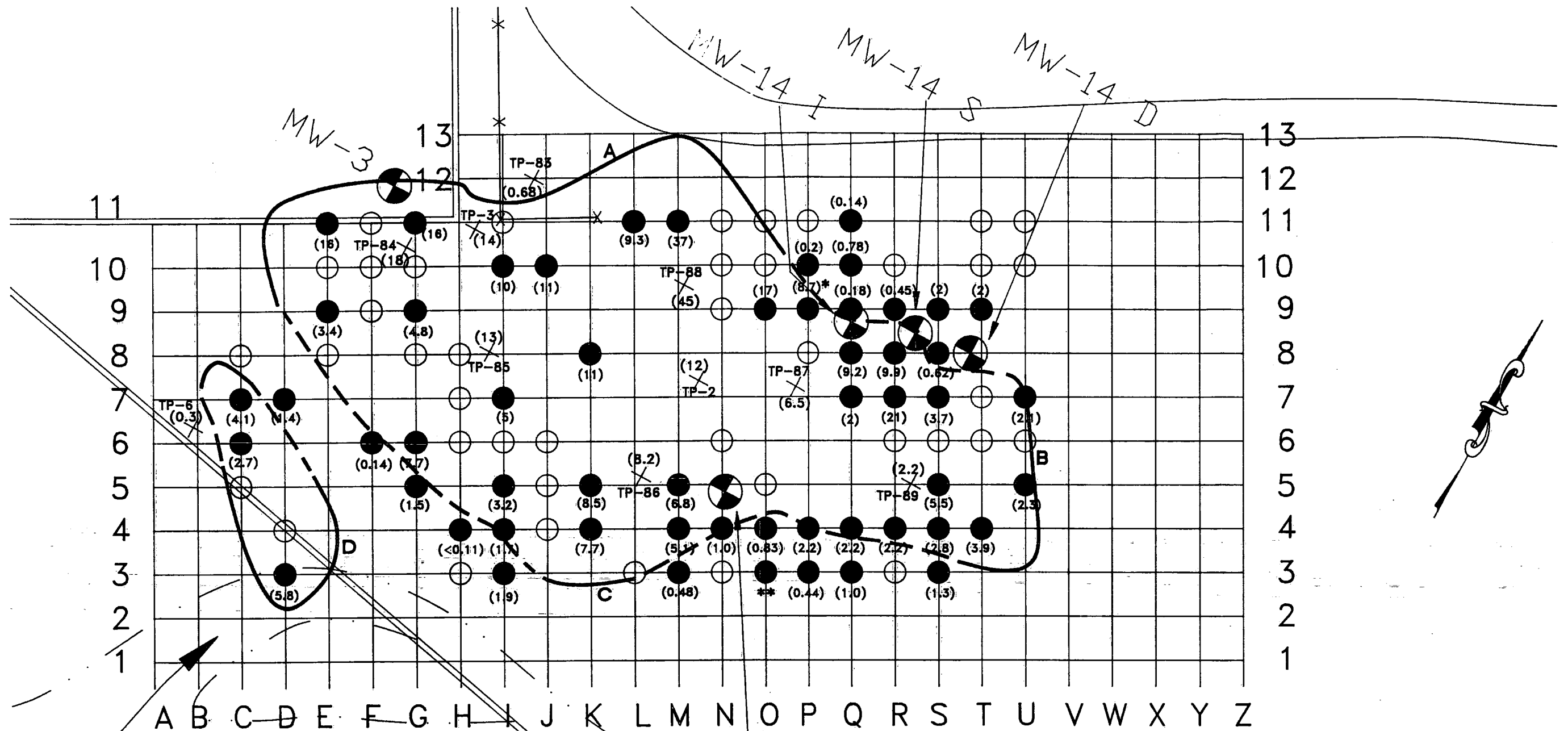
Waste disposal characteristic samples will be collected from the stockpiled soils. Based on the estimated volume of soil requiring remediation, grab samples will be collected for every 20 cubic yards. Every five grab samples (located adjacent to each other) will be composite at the lab on an equal weight basis into composite samples. The samples will be analyzed for disposal characteristics, as described in the Quality Assurance Project Plan (QAPP).

3.4.3 Post-Excavation Analytical Needs:

During excavation of the PCB area, immunoassay screening specific to PCB 1254 will be used to direct the extent of remediation required for low concentration PCB contaminated soils. The post-excavation samples discussed herein do not include the immunoassay screening, but are specific to the post-excavation samples that will be collected and sent to a NJDEP certified laboratory for analysis.

The "large" PCB excavation is estimated as having an 11,000 square feet area and 400 linear feet perimeter. The "small" PCB excavation is estimated as having an 850 square feet area and a 125 linear feet perimeter. Since the excavated area has a perimeter exceeding 300 linear feet, the sampling frequency specified in the *Technical Requirements for Site Remediation (N.J.A.C. 7:26E)* will be reduced.

A total of six (6) sidewall samples (collected from the top of the sidewall) and nine (9) excavation bottom samples will be collected for total PCB analysis. This frequency is considered adequate since immunoassay screening will be used to direct the vertical and horizontal extent of excavation. Further, delineation sampling was previously conducted in this area. The delineation sampling program is described in Section 2.6.2 of the Remedial Action Workplan. The program delineated approximately one-half of the excavations' perimeters. The perimeter segments which have been delineated to the site specific cleanup criterion of 2 mg/kg are depicted on the attached Figure 3-1 as dashed lines. For the perimeter segments which delineation sampling has not adequately identified the lateral extent of contamination (solid lines on Figure 3-1), three (3) perimeter samples will be collected from the perimeter segment marked "A" (northwest perimeter of the "large" excavation), and one (1) perimeter sample will be

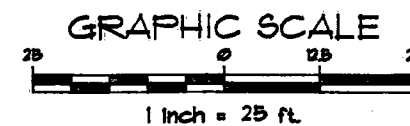


LEGEND

- X TESTPIT SAMPLE LOCATIONS
- SAMPLE COLLECTED & ANALYZED
- SAMPLE COLLECTED
- (5.8) PCB CONCENTRAION (MG/KG)
- ESTIMATED PERIMETER OF EXCAVATION REQUIRING POST-EXCAVATION SAMPLING.
- - - ESTIMATED PERIMETER OF EXCAVATION NOT REQUIRING SAMPLING DUE TO RESULTS OF PRIOR DELINEATION SAMPLING EFFORTS.

NOTE:

- * RESULTS ON A WET WEIGHT BASIS. THERE WAS NOT SUFFICIENT SAMPLE TO DETERMINE % SOLIDS.
- ** SAMPLE 03 WAS EXTRACTED 11 JANUARY, 1 DAY EXCEEDING HOLDING TIME.



PROJECT NAME:
REMEDIAL ACTION WORKPLAN
 WHARTON, NEW JERSEY
 CLIENT NAME:
LE CARPENTER AND COMPANY

PCB POST-EXCAVATION SAMPLING

DATE: 10/5/94
 FIGURE #: 3-1

collected each from the perimeter segments marked "B" (northeast perimeter of the "large" excavation), "C" (southern perimeter of the "large" excavation), and "D" (southern perimeter of the "small" excavation).

Additional samples will be collected for DEHP analysis from the area in the "large" excavation bounded by the excavation perimeter on the northwest and southeast sides, and by grid lines "I" and "R" on the southwest and northeast sides, respectively. This area encompasses test pit locations from which samples were collected during the Remedial Investigation study that indicated elevated levels of DEHP. Test pit locations (TP-3, TP-6, TP-84, TP-89), from which samples were collected that indicated compliance with the site specific Impact to Ground Water soil cleanup criterion for DEHP, are excluded from this area. This portion of the excavation is estimated as having a 6,900 square feet area and a 325 linear feet perimeter. Since this area's perimeter exceeds 300 linear feet, a reduction of the sampling frequency specified in the *Technical Requirements for Site Remediation (N.J.A.C. 7:26E)* will be conducted.

A total of five (5) sidewall samples and five (5) excavation bottom samples will be collected for DEHP laboratory analysis from this area. The sidewall samples will be collected from the bottom of the area's 325 linear feet perimeter, at distances of approximately one sample for every 65 linear feet of the area. The bottom samples will be collected at a frequency of one sample for approximately 1400 square feet of this area. This frequency is considered adequate since these soils will be within the groundwater extraction system's capture zone during the Phase II remedial action.

If analyses of the post-excavation soil samples indicate PCBs remain on site at concentrations in excess of the site specific cleanup criterion of 2 mg/kg, additional soils will be excavated to a maximum depth of two (2) feet below grade per the Record of Decision. If post-excavation soil samples indicate additional excavation is required to comply with the site specific cleanup criterion for DEHP, the maximum depth of the excavation will be the depth to the static water table. All soils excavated specifically for DEHP from this area (i.e.: PCB concentrations are in compliance with the site specific cleanup criterion of 2 mg/kg) will be stockpiled on site for later consolidation with the bulk of DEHP-contaminated soil. The consolidation will be performed by placing the stockpiled soil under the full scale infiltration gallery's aggregate bed at the time of its installation during the Phase II remedial action. These soils will then undergo bioremediation with the remainder of the DEHP-contaminated soils on site.

3.4.4 Dust and Odor Control:

A Mini-RAM particulate monitor will be used onsite to monitor particulate levels. A site specific action level for PCB-contaminated soil has been set at 2.5 milligrams per cubic meter (mg/m³). This level takes into account the maximum concentration of PCB in any soil sample collected from this area. Engineering controls (i.e.: personal protective equipment (PPE), potable water mist) will be used to minimize personnel contact with dust.

Wind speed and direction will be determined and recorded in the field logbook. Periodic air monitoring will be performed at the site perimeter downwind of intrusive activities. A Mini-RAM will be used for the perimeter monitoring. If sustained elevated levels of dust are detected at the site perimeter, engineering controls (i.e., water mist spray etc.) will be applied to the excavation and/or stockpiled soils to reduce the generation of airborne contaminants. If these measures do not adequately lower the concentrations of the excavation will be closed and PCB soil excavation activities will cease.

3.4.5 Soil Erosion and Sediment Control:

Stockpiled soil will be placed on and covered by polyethylene sheeting. Engineering controls used to prevent sedimentation and erosion will be consistent with the Soil Erosion and Sediment Control Plan, presented in Appendix H.

3.4.6 Restoration:

Restoration of the excavation will be performed in accordance with the Wetland Mitigation Plan, presented in Appendix G. Adherence to the Wetlands, Mitigation Plan will restore the area to its pre-remediation conditions with respect to topography, hydrology, and vegetation.

3.4.7 Disposition of Wastes:

The excavated soil will be disposed of off site, in accordance with all applicable laws and regulations. Bulked, excavated soil will be disposed of in a manner consistent with the findings of its waste disposal characteristics.

SECTION 4.0

GROUNDWATER REMEDIAL DESIGN DATA ACQUISITION AND WELLFIELD UPGRADE

The containment and remediation of groundwater in conjunction with in-situ soil remediation requires that detailed pre-design data be collected to meet the following needs:

- Determination of the locations, spacing, and design of the groundwater extraction/reinjection systems; and
- Determination of treatment requirements for groundwater used in three different ways. They include: (1) groundwater separation and reinjection into the shallow aquifer; (2) infiltration/ percolation into the soil for in-situ (vadose zone) soils treatment; and (3) reinjection of small quantities of polished, potable groundwater into the deeper aquifer.

Meeting these needs will require specific pumping and infiltration/reinjection testing followed by design modelling of the extraction/reinjection system. Limited additional groundwater sampling for select parameters related to the treatment system's effectiveness will be combined with the results of this design modelling to allow for final treatment system design.

This workplan includes a plan to optimize the monitoring wellfield to eliminate damaged, unreliable, and unnecessary wells. Those wells identified for elimination will not assist in the remediation of the site and could, in some cases, become a liability. Where necessary, replacement wells will be installed.

The remedial design data acquisition and wellfield upgrade consists of the following activities: (1) aquifer pumping tests; (2) infiltration/injection testing; (3) numerical modelling; (4) monitoring point abandonment and replacement; and (5) chemical analyses.

4.1 AQUIFER PUMPING TEST DESIGN

Aquifer pumping tests are required at the site for the accurate determination of aquifer parameters for the design of an effective recovery system. Aquifer pumping tests will be performed in the shallow(a) aquifer zone, above the extensive onsite clay layer, and the shallow aquifer zone, beneath the clay layer.

The aquifer tests will provide data from which aquifer characteristics can be derived. These aquifer characteristics include: (1) hydraulic conductivity; (2) transmissivity; (3) storativity; (4) heterogeneity/anisotropy; and (5) aquifer zone hydraulic connection. These characteristics will be used to estimate the size of capture zones, to perform the groundwater modeling effort, and to allow the design of an extraction/injection system specific for the site.

Water extracted during the pumping tests will be temporarily contained in onsite storage tanks. This stored water will then be used in the pilot scale infiltration test and the shallow(a) aquifer zone reinjection test. Between the pumping and injection/infiltration tests, pumped water will be stored onsite for sufficient time until groundwater levels have stabilized.

4.1.1 Shallow(a) Aquifer Zone Pumping Test

A constant rate pumping test will be performed in the shallow(a) aquifer zone at the site. CW-1 has been identified as the pumping well. In order to ensure this aquifer test will yield reliable and useful data, several preliminary steps will be undertaken. These preliminary steps include: (1) identification of background water level trends; (2) performance of a short duration step-drawdown test; and (3) performing the aquifer test for a sufficient duration. During the constant rate pumping test, it is essential to follow the prescribed pumping test methodology. Groundwater samples from CW-1 will be collected from the pumping test discharge water at the beginning and end of this test for analysis of VO + xylenes, BNA, and indicator parameters for pretreatment evaluation.

4.1.1.1 Monitoring Background Water Level Trends

Prior to the performance of the constant rate pumping test, background water level trends will be established so that flow conditions in the static (non-stressed) aquifer can be determined. Water level monitoring will be conducted in some of the piezometers which will be monitored for drawdown during the pumping test, in addition, a background well which is at a sufficient distance from CW-1 will also be monitored. Monitoring for the identification of water level trends will last for approximately two days prior to the start of the test. Table 4-1 presents the estimated monitoring points which will be monitored. These monitoring points may be varied based on actual field conditions.

4.1.1.2 Step-Drawdown Test

A step drawdown test will be performed to determine the optimal pumping rate for the constant rate pumping test. Water generated during this test will be stored in a temporary "day tank" on-site. Upon completion of the test, this stored water will be discharged into either the vadose zone overlying the shallow(a) aquifer zone or directly into the shallow (a) aquifer zone as part of the subsequent infiltration/injection tests.

During the test, water levels will be measured in CW-1 as it is pumped at successively higher rates. At least three steps, lasting for approximately one hour in duration, of increasing pump discharge rates will be run. Pump rates will be approximately 50 percent, 100 percent, and 125 percent of what the well is capable of sustaining. Actual pump rates and pumping duration will be determined in the field. Plots of drawdown versus time on semilog paper will identify the anticipated drawdown for an aquifer test conducted at a rate identified during the step drawdown test.

TABLE 4-1

**SHALLOW(a) AQUIFER (WELL CW-1)
PUMPING TEST MONITORING LOCATIONS
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

Monitoring Points	Measurement Method (Tentative)	Measurement Frequency (Tentative)	Distance From Pumping Well (Estimated)	Screened Interval ⁽³⁾
CW-1 ⁽¹⁾⁽²⁾	Pressure Transducer	Data Logger (Default Log Mode)	Pumping Well	4-12 (NS)
PZ-2A(S) ⁽¹⁾⁽²⁾	Pressure Transducer	Data Logger (Default Log Mode)	120 feet	ND
PZ-2A(D) ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	120 feet	ND
MW-11S	Oil/Water Probe	As Often As Possible	30 feet	3-13 (628.5-618.5)
MW-11I	Pressure Transducer	Data Logger (Default Log Mode)	30 feet	42.2-52.2 (588.6-578.6)
WP-B4	Oil/Water Probe	As Often As Possible	40 feet	2-9 (628-621)
WP-B5	Oil/Water Probe	As Often As Possible	65 feet	2-11 (628-619)
DC-P3 ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	200 feet	Drainage Channel Gauge
RP-02 ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	180 feet	River Channel Gauge
MW-08	Pressure Transducer	Data Logger (Default Log Mode)	160 feet	0.5-20 (627.5-608)
WP-B6	Oil/Water Probe	As Often As Possible	85 feet	2.5-10.5 (627-619)
MW-6A ⁽⁴⁾	Pressure Transducer	Data Logger (Default Log Mode)	30 feet	ND ⁽⁴⁾
MW-17S (Background) ⁽¹⁾	Stevens Recorder	Continuous	425 feet	3-13(630-620) ⁽⁵⁾

Notes:

- (1) - Locations to be monitored as part of the background water level trends monitoring.
- (2) - These wells are the proposed replacement wells/piezometers.
- (3) - Screened interval is presented in feet below grade (elevation).
- (4) - This well will replace MW-6 (Section 4.4)
- NS - Not Surveyed
- ND - Presently this well has not been installed, as a result, this data has not been determined

Monitoring points monitored with pressure transducers will also be monitored during the recovery test. The data logger will be stepped and the log mode will reinitiate.

4.1.1.3 Aquifer Test Methodology

During the aquifer test, well CW-1 will be pumped at a constant rate, determined by the step-drawdown test. The constant rate pumping test will last for at least eight hours. However, the test shall be performed for a sufficient duration so that aquifer characteristics can be identified. The actual duration of the test will be based on the plotting and evaluation of data in the field.

Monitoring points identified in Table 4-1 are tentatively scheduled to be monitored for drawdown at the frequency identified. More/fewer locations may be selected based on field conditions. At locations where Light Non-Aqueous Phase Liquid (LNAPL) is not present, pressure transducers or Stevens® Continuous Water Level Recorders may be utilized to monitor water level fluctuations. At well locations where LNAPL is present, measurements will be collected using an oil/water interface probe. The oil/water probe will provide measurements of the thickness of the product column and the thickness of the water column within the well at different time intervals into the test.

During the test, discharged water will be pumped into temporary "day tanks" on site and later used during the injection/infiltration test. In addition to monitoring water levels, precipitation measurements will be collected.

All data acquired during the test will be reduced and analyzed. Analysis will be performed using a method applicable for unconfined aquifers.

4.1.1.4 Recovery Test

Upon completion of the pumping test, the pump in CW-1 will be turned off. Water levels will be measured in monitoring points where drawdown was noted. Measurements will continue until 90 percent recovery is obtained in CW-1.

4.1.2 Shallow Aquifer Zone Pumping Test

RW-2 will be the pumping well for the test to be conducted in the shallow/intermediate aquifer zones (below the clay layer). RW-2 is screened beneath the clay, separating it from the shallow(a) aquifer zone. In general, the same procedures used in the shallow(a) aquifer pumping test will be followed during the shallow aquifer zone pumping test.

4.1.2.1 RW-2 Redevelopment

RW-2 will be redeveloped in an attempt to increase its efficiency. Development will be performed by the pump and surge development technique. During the development process, specific capacity tests will be conducted intermittently to identify the drawdown associated with a specific pump rate. Development will continue until specific capacity rates have approximately stabilized.

4.1.2.2 Monitoring Background Water Level Trends

Background water level trends will be identified prior to the pumping test. This task will be conducted for reasons similar to those that apply to CW-1. Table 4-2 provides the monitoring points which will be monitored for background trends.

4.1.2.3 Step-Drawdown Test

This test will be performed after the redevelopment of RW-2 is complete. The test will be conducted for reasons similar to those that apply to CW-1. An estimate of the pump rates for this step-drawdown test will be identified during the specific capacity tests conducted during well redevelopment. It is anticipated that three steps lasting for approximately one hour each will be performed, actual step duration shall be determined in the field. Water accumulated during this test will be stored and handled in a manner similar to that generated during the step drawdown and the constant rate pumping tests performed in CW-1.

4.1.2.4 Aquifer Test Methodology

During the test this well will be pumped at a constant rate. It is anticipated that this test will last for eight hours in duration. However, this test will last for a sufficient duration from which the aquifer characteristics can be determined. Water levels and their frequency of measurement will be monitored in wells identified in Table 4-2. More/fewer monitoring points will be monitored based on field conditions. During the test, discharged water will be containerized in holding tanks. Analysis of data collected during the test will be made using the appropriate method after review of the drawdown curves for several monitoring points.

Groundwater from RW-2 will be sampled from the pump discharge at the beginning and end of this test for analysis of VO + xylenes, BNA, and indicator parameters.

4.1.2.5 Recovery Test

Water level measurements will be performed during the recovery period immediately following the pump test, and will also be evaluated during the test results analysis. This task will be conducted in a manner and for reasons similar to those that apply to CW-1.

4.2. INFILTRATION/INJECTION TESTS DESIGN

Infiltration and injection tests are needed to develop design parameters for both the in-situ soil bioremediation and groundwater extraction/reinjection systems. An infiltration test will be performed to calculate the optimal percolation rate for groundwater used to treat the soil during in-situ bioremediation. This calculation will be important for determining groundwater treatment system requirements. A second test will be conducted to determine the rate at which groundwater can be reinjected to the aquifer zones during groundwater remediation. With the

TABLE 4-2

**SHALLOW AQUIFER (WELL RW-2) PUMPING TEST MONITORING LOCATIONS
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

Monitoring Points	Measurement Method (Tentative)	Measurement Frequency (Tentative)	Distance From Pumping Well	Screened Interval
RW-002 ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	Pumping Well	2-29 (627-600)
MW-14I ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	120 feet	31-41 (595-585)
PZ-2A ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	45 feet	ND
PZ-2A ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	45 feet	ND
MW-14S ⁽¹⁾	Pressure Transducer	Data Logger (Default Log Mode)	120 feet	1-11 (625-615)
MW-23D	Water Level Indicator	As Often As Possible	225 feet	ND
MW-13S	Water Level Indicator	As Often As Possible	120 feet	4-15 (627-616)
MW-13I	Water Level Indicator	As Often As Possible	120 feet	36-46 (595-585)
MW-23S	Pressure Transducer	Data Logger (Default Log Mode)	225 feet	1-6
MW-8	Water Level Indicator	As Often As Possible	100 feet	1-20 (627.39-607.79)
MW-17S (Background) ⁽¹⁾	Stevens Recorder	Continuous	470 feet	3-13 (630-620)
MW-6A ⁽²⁾	Pressure Transducer	Data Logger (Default Log Mode)	20 feet	ND

Notes:

- (1) - Locations to be monitored as part of the background water level trends monitoring.
 - (2) - This well will replace MW-6 (See Section 4.4).
 - (3) - Screened interval is presented in feet below grade (elevation).
 - NS - Not Surveyed
 - ND - Presently this well has not been installed, as a result, this data has not been determined
- Monitoring points monitored with pressure transducers will also be monitored during the recovery test. The data logger will be stepped and the log mode will reinitiate.

exception of the shallow/intermediate aquifer zone injection test, these tests will be conducted in an area known to require groundwater remediation, using groundwater accumulated during the step drawdown, and constant rate pumping tests. Finally, potable water will be used to determine the injection capacity of the intermediate aquifer for disposal of the relatively small volume of polished, potable groundwater which will be generated during Stage II groundwater remediation.

Proper completion of these tests will allow construction of the smallest water treatment system capable of meeting Phase II (Stage I) and Phase II (Stage II) groundwater remedial action requirements.

4.2.1 Infiltration Testing

During the field activities, two types of tests will be performed to identify the permeability of the vadose zone. These tests are specifically:

- percolation tests, and a
- pilot scale infiltration test.

4.2.1.1 Percolation Tests

Percolation tests will be performed at three locations for the determination of the design parameters for the in-situ biotreatment system design. These locations are within areas where the bioremediation of soils is required. The locations of the proposed tests include: (1) in the vicinity of WP-A4, (2) in the vicinity of CW-1, and (3) in the vicinity of WP-A7. Percolation tests will be performed in accordance with N.J.A.C. 7:9A-6.4.

4.2.1.2 Pilot Scale Infiltration Test

A pilot scale infiltration gallery will be installed within the excavation for the remediation of the "Disposal Area". This system will be designed for the bioremediation of soils according to specifications which will tentatively be used for the construction of the entire infiltration system at the site. Details are presented in Appendix I. The pilot scale system will be installed during backfilling, after completion of the excavation of the disposal areas wastes, and will eventually be connected to the site wide system.

During the pilot-scale study, the system capacity will be established by "flooding" the system with water accumulated during the aquifer tests to it's estimated capacity, and measuring the additional volume of flow the system is capable of receiving over a given time period. This will be done by measuring the additional flow the system is capable of receiving on an hourly basis. Tests duration will be limited based upon the volume of water accessible. Nearby monitoring points will be monitored periodically during this test to identify potential mounding effects.

4.2.1.3 Injection Testing

Two injection tests will be performed in two separate aquifer zones present at the site. The newly located CW-2, after it's removal from the "Disposal Area", during the area's remediation, will be used as the injection point during the injection test in the shallow(a) aquifer zone. The deeper injection test conducted in the shallow/intermediate aquifer zones will be performed in RW-3 using potable water.

An injection test in CW-2, relocated in the vicinity of WP-B2, will be performed with accumulated pumping test water to quantify the capacity of the shallow(a) aquifer zone's ability to accept water. This test will evaluate the potential for injecting water into the shallow(a) aquifer zone. Monitoring points in which water level measurements will be conducted are presented in Table 4-3. More or fewer monitoring points may be monitored dependent on field conditions.

During this test, accumulated aquifer water will be injected into the well at increasing rates (steps). It is anticipated that three steps lasting for at least twelve hours each will be performed. The tests duration will be dependent on the total volume of water available from storage in the onsite tanks. As the anticipated mounding occurs water levels will be collected in nearby monitoring points. If mounding is identified in wells screened beneath the onsite clay layer, i.e., WP-D1 (proposed), PZ-2A (proposed), or MW-11I, a sample for VO+xylylene will be collected. This sample will provide insight into the effect of injecting water into the shallow(a) aquifer zone and driving contaminants into different aquifer zones.

An injection test in RW-3 will be performed with potable water to quantify the capacity of the intermediate aquifer zone's ability to accept water. This test will evaluate the potential for gravity feed injection of treated, polished water which cannot be returned to the shallow(a) aquifer zones.

During the test, potable water will be injected into the well at successively increasing steps. It is anticipated that three steps will be required. Flow rates will be determined in the field based on actual conditions. Water levels will be monitored in RW-3 and WP-B5 via pressure transducers or water level indicators. Each step is anticipated to run for approximately four hours.

4.3 NUMERICAL MODELING

Using the parameters developed from the pumping injection test analysis, the recovery well/injection system configuration will be optimized by numerical modeling. It is anticipated that MODFLOW, a numerical, 3-dimensional, block-centered finite difference code with its MODELCAD pre-processing and post-processing, will be used. Modeling will be used for the following purposes:

TABLE 4-3

**MONITORING POINTS
INJECTION TEST CW-2
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

Monitoring Point	Method of Measurement	Distance From Injection Well	Screened Interval
WP-B5	Oil/Water Probe	50 feet	2-11 (628-619)
WP-B4	Oil/Water Probe	30 feet	2-9 (628-621)
WP-B3	Oil/Water Probe	50 feet	3-11 (628.7-620.7)
WP-D1	Pressure Transducer	ND	ND
CW-2	Pressure Transducer	Injection Well	ND
WP-B2	Pressure Transducer	10 feet	3-11 (627.5-619.5)
WP-B10	Pressure Transducer	40 feet	3-11 (627.5-619.5)
MW-11S	Oil/Water Probe	50 feet	3-13 (628.5-618.5)
MW-2S	Pressure Transducer	130 feet	ND
MW-6A	Pressure Transducer	150 feet	ND
MW-17S (Background)	Stevens Recorder	400 feet	3-13 (630-620)
MW-11I	Water Level Indicator	ND	ND
PZ-2A(R)	Water Level Indicator	ND	ND

Notes:

ND - Not determined presently.

Method of measurement and distance from injection well are tentative.

Monitoring points PZ-2A(R) and WP-D1 are proposed wells. It is anticipated that the screens will be set immediately below a clay layer.

- Determining the locations and sizes of extraction/reinjection/infiltration systems;
- Determining the flow rate of groundwater which requires treatment as part of Stage I (separation only) and Stage II (separation, VOC treatment, and/or DEHP treatment) groundwater remedial action;
- Demonstrating that the extraction/injection system design will contain contaminated groundwater and allow remediation in accordance with ROD requirements;
- Allowing the selection of groundwater monitoring locations used to document system effectiveness; and
- Providing a long-term optimization tool for management of the extraction/reinjection system.

4.4 MONITORING POINT ABANDONMENT/REPLACEMENT

4.4.1 Monitoring Point Abandonment

Several of the site monitoring wells screened intervals cross multiple zones and require abandonment. The reasons for the abandonment of specific monitoring points include: (1) the monitoring well's riser/screen bridges a clay or silt layer; (2) the well's screened interval is too large and sampling does not provide data for a specific interval; and (3) the well or piezometer is located in an area which must be excavated as part of the soil remediation which will be performed at the site. A list of monitoring points for abandonment are presented in Table 4-4. Additional wells recommended for abandonment at a later date are presented in Table 4-5. A rationale for each well abandonment is also provided. State regulations require that all wells be abandoned by a licensed driller. The abandonment procedure will be in compliance with N.J.A.C. 7:9-9.

4.4.2 Monitoring Point Installation/Replacement

The installation of additional monitoring points is justified in a few areas to evaluate specific hydrogeologic zones at the site. The reasons for the installation of new monitoring points include: (1) to replace monitoring points that were improperly designed; (2) to aid in the analysis of the aquifer pumping tests which are to be performed as part of the remedial design data collection; (3) to monitor specific hydrogeologic zones, (i.e., above and immediately below the clay unit); and (4) to demonstrate that the groundwater recovery system is effective through the installation of sentinel wells located downgradient of the recovery systems to monitor water quality. A list of proposed monitoring points for installation are presented in Table 4-6. A rationale for each proposed installation is also provided.

TABLE 4-4

**MONITORING POINTS REQUIRING ABANDONMENT
REMEDIAL ACTION WORK PLAN
L.E. CARPENTER, WHARTON, NEW JERSEY**

Monitoring Point Designation	Rationale for Abandonment
MW-1	This monitoring well is in disrepair. The well's riser and protective casing is bent and may be cracked, and thus, jeopardizes its integrity. A replacement well is proposed to replace this monitoring point during upcoming field work.
MW-2	This monitoring well has a 25.5 foot long screen which fully penetrates a clay unit. This well's screen is not set to monitor one specific aquifer zone. A replacement piezometer cluster is proposed to replace this monitoring point during the upcoming field work.
MW-6	This well has a 20 foot long screen which fully penetrates a clay unit. This well's screen is not set to monitor one specific aquifer zone. A shallow replacement piezometer is proposed to replace this monitoring point during the upcoming field work.
MW-12S and MW-12I	These two wells are located in an area requiring excavation for soil remediation proposes. The presence of piezometers WP-C1, WP-C2, WP-C3, and WP-C4 are present to monitor flow conditions in this area.
WP-B9	This piezometer is located in the "Disposal Area" which requires excavation for soil remediation.

Notes:

Dependent on the extent of excavation for the soil remediation of "hot spots" across the site, additional wells may require abandonment.

Caisson well CW-2, which is located in the "Disposal Area" shall be removed during the excavation of the area and reinstallation in the vicinity of WP-B2.

TABLE 4-5

**MONITORING POINTS REQUIRING ABANDONMENT
DURING SUBSEQUENT ACTIVITIES
REMEDIAL ACTION WORK PLAN
L. E. CARPENTER, WHARTON, NEW JERSEY**

<u>Monitoring Point Designation</u>	<u>Screen Length(Ft)</u>	<u>Rationale For Abandonment</u>
MW-5	30	1,2,3
MW-7	20	2,3
MW-10	20	2,3
MW-11D	10	3,4,5
MW-14D	10	3,4,5
MW-17D	10	3,4,5
MW-18D	10	4,5

Notes:

1. Denotes the wells's screen is too long and may not provide the specific data required for evaluation of a specific aquifer.
2. Denotes the well's screen completely penetrates a clay layer(s). As a result, water level and groundwater samples may not be representative of a specific zone.
3. A well's riser or screen penetrates a clay or silt.
4. The Record of Decision (ROD) requires no further action in this area.
5. The "deep" wells, identified with the suffix-D, have well screens which are all not set in a specific aquifer zone.

TABLE 4-6

**PROPOSED MONITORING POINT INSTALLATION/REPLACEMENT
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

<u>Monitoring Point Designation</u>	<u>Monitoring Point Location</u>	<u>Rationale</u>
RP-4 (Survey Point)	Washington Pond	Data point will further define surface water conditions at the site.
MW-1A*	Replace MW-1	Replacement well for MW-1. This well shall be located between piezometers WP-A4 and WP-A1. The well will consist of 4-inch diameter stainless steel so that it can accommodate a multi-phase (multi-fluid) pump for LNAPL removal and depression of the water table.
PZ-2A(S) PZ-2A(R)	Replace MW-2	Replacement monitoring piezometer cluster to be installed between the present location of MW-2 and WP-B9. The cluster will have one screen above the clay (identified in the previous boring logs). It will be identified as MW-2A(S). The "deeper" well in this cluster will be double cased and the screen will be set below the clay. The well will be identified as MW-2A(D). Each will consist of 2-inch diameter PVC. These points are located to monitor water quality within the shallow(a) and shallow aquifer zones and for pump test analysis.
PZ-6A	Replace MW-6	The piezometer will consist of 2-inch diameter PVC screened above the clay layer.
MW-13(R)	To form a cluster of wells on Air Products	To Evaluate the possibility of the presence of LNAPL existing beneath a clay unit. A 2-inch diameter PVC well will be installed. The screen will be set below the clay unit identified in the boring log for MW-13. Installation of this well is contingent on property access granted by Air Products Corp.
WP-D1	Monitoring point immediately adjacent to the infiltration gallery and the relocated CW-2.	To identify mounding associated with the infiltration test and the shallow(a) injection test. A 2-inch diameter PVC well will be installed. The screen will be set below the clay unit.
Sentinel Wells**		Additional monitoring wells may be required downgradient of the proposed recovery wells to prove that the groundwater plume has been captured.

Notes:

- * No clay was encountered (noted) during the installation of MW-1.
- ** Sentinel wells will be installed at a later date after operation of the recovery system has established new water table configuration.

4.5 GROUNDWATER AND FLOATING PRODUCT SAMPLING

Groundwater samples and LNAPL samples will be collected from various monitoring points within the well and piezometer network to evaluate specific pre-design considerations. Results of this sampling event will provide an updated groundwater analytical database and aid in the design of the treatment system. Groundwater samples will be analyzed by a NJDEPE-certified laboratory for select analytical parameters. These analytical parameters are presented in Table 4-7. Table 4-8 is a list of the indicator parameters. Samples collected from the pumping wells at the beginning and end of the pumping tests will be analyzed for volatile organics plus xylenes, base/neutral/acid extractables, and water quality indicator parameters. LNAPL samples will be collected from specific wells and will be analyzed for gas chromatographic (GC) fingerprint and specific gravity as presented in Table 4-9.

4.5.1 Groundwater Samples

One round of groundwater samples will be collected from selected locations within the onsite monitoring network. Table 4-7 provides the monitoring point designation and the analytical parameters for which samples will be analyzed.

During the two proposed aquifer pumping tests, two samples will be collected from each of the pumping wells. The first sample will be collected one hour into the test and the other approximately one-half hour prior to turning off the pump.

4.5.2 LNAPL Samples

LNAPL samples for analyses of GC fingerprint, and specific gravity will be collected from selected monitoring points. These monitoring points are presented in Table 4-9. Sampling of LNAPL from a specific monitoring point assumes that enough sample volume is present within the monitoring point so that a sample can be collected.

TABLE 4-7

**PROPOSED GROUNDWATER SAMPLING PARAMETERS/RATIONALE
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

<u>Monitoring Point Designation</u>	<u>Monitoring Point Location</u>	<u>Rationale</u>
MW-4	VO+xylenes, DEHP, indicator parameters	1
MW-14S	VO+xylenes, DEHP, indicator parameters	1
MW-22	VO+xylenes, DEHP	1
MW-25	VO+xylenes, DEHP	1
MW-15S	VO+xylenes, DEHP	1
MW-1A	VO+xylenes, DEHP, indicator parameters	1,2
PZ-2A(S)	VO+xylenes, DEHP, indicator parameters	1,2
PZ-2A(R)	VO+xylenes, DEHP, indicator parameters	1,2,6
MW-23	VO+xylenes, DEHP	1
MW-13(R)	VO+xylenes, DEHP	1
GEI-2I	VO+xylenes, DEHP	1
GEI-2S	VO+xylenes, DEHP	1
MW-16S	VO+xylenes, DEHP, indicator parameters	1
MW-16I	VO+xylenes, DEHP, indicator parameters	1
MW-15I	VO+xylenes, DEHP	1
MW-17S	VO+xylenes, DEHP	1
MW-14I	VO+xylenes, DEHP, indicator parameters	1
MW-8	VO+xylenes, DEHP	1
MW-11I	VO+xylenes, DEHP, indicator parameters	1,6
MW-11D	VO+xylenes, DEHP	1,4
MW-18S	VO+xylenes, DEHP, indicator parameters	1
MW-18I	VO+xylenes, DEHP, indicator parameters	1
MW-13S	VO+xylenes, DEHP	1
MW-13I	VO+xylenes, DEHP	1
MW-9	VO+xylenes, DEHP	1
PZ-6A	VO+xylenes, DEHP indicator parameters	1,2
WP-D1	VO+xylenes, DEHP	1,2,5,6
CW-1	VO+xylenes, BNA, indicator parameters	1,3
RW-2	VO+xylenes, BNA, indicator parameters	1,3

Notes:

- | | |
|---|---|
| 1.
2.
3.
4.

5.

6. | <ul style="list-style-type: none"> - Sample collected to update the database. - Well is newly installed, and this is the first round of sampling. - Samples will be collected at specific intervals during the pumping test (See Section 4.5.1). - Removal of this well is proposed. The groundwater sample will be collected prior to abandonment, and abandonment will be contingent upon analytical results. - Sample will be analyzed on a quick turnaround so that analytical results will be available prior to the injection test (see Section 4.2.1.3) - An additional sample may be collected for VO+xylene, if mounding is identified during the injection test in CW-2. - If LNAPL is detected in the well, a sample for the parameters identified above will not be collected. |
| VO+xylenes
DEHP
BNA
Indicator parameters | <ul style="list-style-type: none"> - Volatile organic compounds with calibration for xylenes. - Bis(2-ethyl hexyl)phthalate. - Base/neutral/acid extractable compounds. - Water quality indicator parameters, see Table 4-8. |

TABLE 4-8

**WATER QUALITY INDICATOR COMPOUNDS
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

Alkalinity
Bicarbonate
Biological Oxygen Demand
Chloride
Chemical Oxygen Demand
pH
Sulfate
Total Dissolved Solids
Total Suspended Solids
Iron
Calcium
Manganese
Arsenic
Lead
Sodium
Antimony
Magnesium
Calcium
Total Kjeldahl Nitrogen
Nitrate Nitrogen
Nitrite Nitrogen
Phosphate
Total Hardness
Turbidity
Color
Total Organic Carbon

Note:

All samples will be analyzed at a NJDEPE-certified laboratory by analytical methods specified in N.J.A.C. 7:26E.

TABLE 4-9

**PROPOSED LNAPL SAMPLING POINTS
L. E. CARPENTER REMEDIAL ACTION WORK PLAN
WHARTON, NEW JERSEY**

<u>Monitoring Point Designation</u>	<u>Analytical Location</u>	<u>Rationale</u>
MW-23D*	GCF/SG	Identify chemical constituents present in the LNAPL.
MW-11S	GCF/SG	Update the chemical composition of the LNAPL.
WP-B4	SG	Point monitored during aquifer test.
WP-B5	SG	Point monitored during aquifer test.
WP-B6	SG	Point monitored during aquifer test.
MW-1A	GCF/SG	Identify chemical constituents present in the LNAPL.

Notes:

- GCF - Gas chromatographic fingerprint.
- SG - Specific gravity.
- Specific gravity analysis will be performed on points which will be monitored during the pump testing so that an accurate corrected water levels can be determined.
- Samples will be collected only if LNAPL is detected in sufficient volume to fill the required sampling jars.
- * - This well will be installed during Phase I remedial action. If LNAPL is encountered in MW-23D, a sample will be collected.

APPENDIX A
SCHEDULE

L.E.CARPENTER PHASE I REMEDIAL ACTION SCHEDULE

Task Name	Start	Duration	End	1994											
				14/Aug	21/Aug	28/Aug	04/Sep	11/Sep	18/Sep	25/Sep	02/Oct	09/Oct	16/Oct	23/Oct	30/Oct
Groundwater Remedial Design Data Acquisition	15/Aug/94	130.00 d	20/Feb/95												
Pilot Infiltration Gallery "Design"	15/Aug/94	10.00 d	26/Aug/94												
Pilot Scale Infiltration Gallery Revisions	03/Oct/94	2.00 d	04/Oct/94												
Well Abandonment	31/Oct/94	3.00 d	02/Nov/94												
Percolation Tests	31/Oct/94	3.00 d	02/Nov/94												
Well Closure (Remaininal)/Installation	21/Nov/94	7.00 d	01/Dec/94												
Groundwater Sampling	15/Dec/94	5.00 d	21/Dec/94												
Aquifer Testing - Shallow (A) / Shallow	21/Dec/94	22.00 d	24/Jan/95												
Aquifer Testing Data Interpretation	21/Dec/94	25.00 d	27/Jan/95												
Modelling Groundwater Conditions	20/Jan/95	22.00 d	20/Feb/95												
Organic Hot Spots	31/Oct/94	6.00 d	07/Nov/94												
Soil Borings/Sampling - Hot Spot 2	31/Oct/94	1.00 d	31/Oct/94												
Hot Spot 2 Analytical Results	07/Nov/94	1.00 d	07/Nov/94												
Excavate Organic Hot Spots, Place in Disposal Area	07/Nov/94	7.00 d	15/Nov/94												
Disposal Area	01/Nov/94	33.00 d	19/Dec/94												
Set Up Waste Staging Area	01/Nov/94	2.00 d	02/Nov/94												
Soil Erosion/Sediment Controls	03/Nov/94	2.00 d	04/Nov/94												
Excavate, Segregate & Stockpile Wastes/Sludges	07/Nov/94	4.00 d	10/Nov/94												
Waste Characterization Sampling of Stockpile	10/Nov/94	1.00 d	10/Nov/94												
Slur Product From Excavation	11/Nov/94	5.00 d	17/Nov/94												
Waste Characterization Sampling Analytical Results	28/Nov/94	1.00 d	29/Nov/94												
Waste Profile TSDF	29/Nov/94	1.00 d	29/Nov/94												
Install Pilot Scale Infiltration Gallery/Backfill Area	16/Nov/94	3.00 d	19/Nov/94												
TSDF Approval	13/Dec/94	1.00 d	13/Dec/94												
Package & Ship Wastes/Sludges	14/Dec/94	4.00 d	19/Dec/94												
Inorganic Hot Spots	14/Sep/94	71.00 d	27/Dec/94												
Collect Waste Classification Samples	14/Sep/94	1.00 d	14/Sep/94												
Waste Classification Analytical Results	29/Sep/94	1.00 d	29/Sep/94												
Excavate and Stockpile/Backfill Hot Spots	14/Nov/94	3.00 d	16/Nov/94												
Waste Classification Sampling of Stockpiles	16/Nov/94	1.00 d	16/Nov/94												
Waste Classification Analytical Results	30/Nov/94	1.00 d	30/Nov/94												
Waste Profiles - Inorganic Soils to TSDF	02/Dec/94	1.00 d	02/Dec/94												
TSDF Approval for Inorganic Soils, Arrange for Disposal	16/Dec/94	1.00 d	16/Dec/94												
Metal Hot Spot Disposal	19/Dec/94	5.00 d	27/Dec/94												
PCB Area	09/May/95	48.00 d	13/Jul/95												
Set Up Soil Staging Area	09/May/95	2.00 d	10/May/95												
Install Soil Erosion/Sediment Controls	11/May/95	2.00 d	12/May/95												
Excavate, Segregate, and Stockpile Soils	15/May/95	9.00 d	26/May/95												
Post Excavation Sampling	25/May/95	1.00 d	26/May/95												
Post Excavation Analytical Results	01/Jun/95	1.00 d	01/Jun/95												
Backfill/Restoration	12/Jun/95	7.00 d	20/Jun/95												
Waste Characterization Sampling	26/May/95	1.00 d	26/May/95												
Waste Characterization Results	16/Jun/95	1.00 d	16/Jun/95												
Waste Profile TSDF	19/Jun/95	1.00 d	19/Jun/95												
TSDF Approval	05/Jul/95	1.00 d	05/Jul/95												
Package & Ship Wastes	10/Jul/95	4.00 d	13/Jul/95												

Printed: 12/Oct/94

Footer: lecarp1

Milestones ☐ Summary ☐

Note: Schedule is contingent on weather and field conditions.

L.E.CARPENTER PHASE I REMEDIAL ACTION SCHEDULE

Task Name	Start	Duration	End	1994												
				13/Nov	20/Nov	27/Nov	04/Dec	11/Dec	18/Dec	25/Dec	01/Jan	08/Jan	15/Jan	22/Jan	29/Jan	05/Feb
Groundwater Remedial Design Data Acquisition	15/Aug/94	130.00 d	20/Feb/95													
Pilot Infiltration Gallery "Design"	15/Aug/94	10.00 d	26/Aug/94													
Pilot Scale Infiltration Gallery Revisions	03/Oct/94	2.00 d	04/Oct/94													
Well Abandonment	31/Oct/94	3.00 d	02/Nov/94													
Percolation Tests	31/Oct/94	3.00 d	02/Nov/94													
Well Closure (Remaining)/Installation	21/Nov/94	7.00 d	01/Dec/94													
Groundwater Sampling	15/Dec/94	5.00 d	21/Dec/94													
Aquifer Testing - Shallow (A) / Shallow	21/Dec/94	22.00 d	24/Jan/95													
Aquifer Testing Data Interpretation	21/Dec/94	25.00 d	27/Jan/95													
Modelling Groundwater Conditions	20/Jan/95	22.00 d	20/Feb/95													
Organic Hot Spots	31/Oct/94	6.00 d	07/Nov/94													
Soil Borings/Sampling - Hot Spot 2	31/Oct/94	1.00 d	31/Oct/94													
Hot Spot 2 Analytical Results	07/Nov/94	1.00 d	07/Nov/94													
Excavate Organic Hot Spots, Place in Disposal Area	07/Nov/94	7.00 d	15/Nov/94													
Disposal Area	01/Nov/94	33.00 d	19/Dec/94													
Set Up Waste Staging Area	01/Nov/94	2.00 d	02/Nov/94													
Soil Erosion/Sediment Controls	03/Nov/94	2.00 d	04/Nov/94													
Excavate, Segregate & Stockpile Wastes/Sludges	07/Nov/94	4.00 d	10/Nov/94													
Waste Characterization Sampling of Stockpile	10/Nov/94	1.00 d	10/Nov/94													
Slurry Product From Excavation	11/Nov/94	5.00 d	17/Nov/94													
Waste Characterization Sampling Analytical Results	28/Nov/94	1.00 d	28/Nov/94													
Waste Profile TSDF	29/Nov/94	1.00 d	29/Nov/94													
Install Pilot Scale Infiltration Gallery/Backfill Area	18/Nov/94	3.00 d	18/Nov/94													
TSDF Approval	13/Dec/94	1.00 d	13/Dec/94													
Package & Ship Wastes/Sludges	14/Dec/94	4.00 d	19/Dec/94													
Inorganic Hot Spots	14/Sep/94	71.00 d	27/Dec/94													
Collect Waste Classification Samples	14/Sep/94	1.00 d	14/Sep/94													
Waste Classification Analytical Results	29/Sep/94	1.00 d	29/Sep/94													
Excavate and Stockpile/Backfill Hot Spots	14/Nov/94	3.00 d	18/Nov/94													
Waste Classification Sampling of Stockpiles	18/Nov/94	1.00 d	18/Nov/94													
Waste Classification Analytical Results	30/Nov/94	1.00 d	30/Nov/94													
Waste Profiles - Inorganic Soils to TSDF	02/Dec/94	1.00 d	02/Dec/94													
TSDF Approval for Inorganic Soils, Arrange for Disposal	16/Dec/94	1.00 d	16/Dec/94													
Metal Hot Spot Disposal	19/Dec/94	5.00 d	27/Dec/94													
PCB Area	09/May/95	46.00 d	13/Jul/95													
Set Up Soil Staging Area	09/May/95	2.00 d	10/May/95													
Install Soil Erosion/Sediment Controls	11/May/95	2.00 d	12/May/95													
Excavate, Segregate, and Stockpile Soils	15/May/95	9.00 d	25/May/95													
Post Excavation Sampling	25/May/95	1.00 d	25/May/95													
Post Excavation Analytical Results	01/Jun/95	1.00 d	01/Jun/95													
Backfill/Restoration	12/Jun/95	7.00 d	20/Jul/95													
Waste Characterization Sampling	26/May/95	1.00 d	26/May/95													
Waste Characterization Results	16/Jul/95	1.00 d	16/Jul/95													
Waste Profile TSDF	19/Jul/95	1.00 d	19/Jul/95													
TSDF Approval	05/Jul/95	1.00 d	05/Jul/95													
Package & Ship Wastes	10/Jul/95	4.00 d	13/Jul/95													

Printed: 12/Oct/94

Footer: lecarp1

Milestones Summary

Note: Schedule is contingent on weather and field conditions.

L.E.CARPENTER PHASE I REMEDIAL ACTION SCHEDULE

Task Name	Start	Duration	End	1995													
				12/Feb	19/Feb	26/Feb	05/Mar	12/Mar	19/Mar	26/Mar	02/Apr	09/Apr	16/Apr	23/Apr	30/Apr	07/May	
Groundwater Remedial Design Data Acquisition	15/Aug/94	130.00 d	20/Feb/95														
Pilot Infiltration Gallery "Design"	15/Aug/94	10.00 d	26/Aug/94														
Pilot Scale Infiltration Gallery Revisions	03/Oct/94	2.00 d	04/Oct/94														
Well Abandonment	31/Oct/94	3.00 d	02/Nov/94														
Percolation Tests	31/Oct/94	3.00 d	02/Nov/94														
Well Closure (Remaining)/Installation	21/Nov/94	7.00 d	01/Dec/94														
Groundwater Sampling	15/Dec/94	5.00 d	21/Dec/94														
Aquifer Testing - Shallow (A) / Shallow	21/Dec/94	22.00 d	24/Jan/95														
Aquifer Testing Data Interpretation	21/Dec/94	25.00 d	27/Jan/95														
Modelling Groundwater Conditions	20/Jan/95	22.00 d	20/Feb/95														
Organic Hot Spots	31/Oct/94	6.00 d	07/Nov/94														
Soil Borings/Sampling - Hot Spot 2	31/Oct/94	1.00 d	31/Oct/94														
Hot Spot 2 Analytical Results	07/Nov/94	1.00 d	07/Nov/94														
Excavate Organic Hot Spots, Place in Disposal Area	07/Nov/94	7.00 d	15/Nov/94														
Disposal Area	01/Nov/94	33.00 d	19/Dec/94														
Set Up Waste Staging Area	01/Nov/94	2.00 d	02/Nov/94														
Soil Erosion/Sediment Controls	03/Nov/94	2.00 d	04/Nov/94														
Excavate, Segregate & Stockpile Wastes/Sludges	07/Nov/94	4.00 d	10/Nov/94														
Waste Characterization Sampling of Stockpile	10/Nov/94	1.00 d	10/Nov/94														
Slur Product From Excavation	11/Nov/94	5.00 d	17/Nov/94														
Waste Characterization Sampling Analytical Results	28/Nov/94	1.00 d	28/Nov/94														
Waste Profile TSDF	29/Nov/94	1.00 d	29/Nov/94														
Install Pilot Scale Infiltration Gallery/Backfill Area	16/Nov/94	3.00 d	19/Nov/94														
TSDF Approval	13/Dec/94	1.00 d	13/Dec/94														
Package & Ship Wastes/Sludges	14/Dec/94	4.00 d	19/Dec/94														
Inorganic Hot Spots	14/Sep/94	71.00 d	27/Dec/94														
Collect Waste Classification Samples	14/Sep/94	1.00 d	14/Sep/94														
Waste Classification Analytical Results	29/Sep/94	1.00 d	29/Sep/94														
Excavate and Stockpile/Backfill Hot Spots	14/Nov/94	3.00 d	16/Nov/94														
Waste Classification Sampling of Stockpiles	16/Nov/94	1.00 d	16/Nov/94														
Waste Classification Analytical Results	30/Nov/94	1.00 d	30/Nov/94														
Waste Profiles - Inorganic Solids to TSDF	02/Dec/94	1.00 d	02/Dec/94														
TSDF Approval for Inorganic Solids, Arrange for Disposal	16/Dec/94	1.00 d	16/Dec/94														
Metal Hot Spot Disposal	19/Dec/94	5.00 d	27/Dec/94														
PCB Area	09/May/95	46.00 d	13/Jul/95														
Set Up Soil Staging Area	09/May/95	2.00 d	10/May/95														
Install Soil Erosion/Sediment Controls	11/May/95	2.00 d	12/May/95														
Excavate, Segregate, and Stockpile Soils	15/May/95	9.00 d	25/May/95														
Post Excavation Sampling	25/May/95	1.00 d	26/May/95														
Post Excavation Analytical Results	01/Jun/95	1.00 d	01/Jun/95														
Backfill/Restoration	12/Jun/95	7.00 d	20/Jun/95														
Waste Characterization Sampling	26/May/95	1.00 d	26/May/95														
Waste Characterization Results	16/Jun/95	1.00 d	16/Jun/95														
Waste Profile TSDF	19/Jun/95	1.00 d	19/Jun/95														
TSDF Approval	06/Jul/95	1.00 d	06/Jul/95														
Package & Ship Wastes	10/Jul/95	4.00 d	13/Jul/95														

Printed: 12/Oct/94

Footer: lecarp1

Milestone ☐ Summary ☐

Note: Schedule is contingent on weather and field conditions

L.E.CARPENTER PHASE I REMEDIAL ACTION SCHEDULE

Task Name	Start	Duration	End	1995											
				14/May	21/May	28/May	04/Jun	11/Jun	18/Jun	25/Jun	02/Jul	09/Jul	16/Jul	23/Jul	30/Jul
Groundwater Remedial Design Data Acquisition	15/Aug/94	130.00 d	20/Feb/95												
Pilot Infiltration Gallery "Design"	15/Aug/94	10.00 d	26/Aug/94												
Pilot Scale Infiltration Gallery Revisions	03/Oct/94	2.00 d	04/Oct/94												
Well Abandonment	31/Oct/94	3.00 d	02/Nov/94												
Percolation Tests	31/Oct/94	3.00 d	02/Nov/94												
Well Closure (Remaining)/Installation	21/Nov/94	7.00 d	01/Dec/94												
Groundwater Sampling	15/Dec/94	5.00 d	21/Dec/94												
Aquifer Testing - Shallow (A) / Shallow	21/Dec/94	22.00 d	24/Jan/95												
Aquifer Testing Data Interpretation	21/Dec/94	25.00 d	27/Jan/95												
Modeling Groundwater Conditions	20/Jan/95	22.00 d	20/Feb/95												
Organic Hot Spots	31/Oct/94	6.00 d	07/Nov/94												
Soil Borings/Sampling - Hot Spot 2	31/Oct/94	1.00 d	31/Oct/94												
Hot Spot 2 Analytical Results	07/Nov/94	1.00 d	07/Nov/94												
Excavate Organic Hot Spots, Place in Disposal Area	07/Nov/94	7.00 d	15/Nov/94												
Disposal Area	01/Nov/94	33.00 d	19/Dec/94												
Set Up Waste Staging Area	01/Nov/94	2.00 d	02/Nov/94												
Soil Erosion/Sediment Controls	03/Nov/94	2.00 d	04/Nov/94												
Excavate, Segregate & Stockpile Wastes/Sludges	07/Nov/94	4.00 d	10/Nov/94												
Waste Characterization Sampling of Stockpile	10/Nov/94	1.00 d	10/Nov/94												
Skim Product From Excavation	11/Nov/94	5.00 d	17/Nov/94												
Waste Characterization Sampling Analytical Results	26/Nov/94	1.00 d	26/Nov/94												
Waste Profile TSDF	29/Nov/94	1.00 d	29/Nov/94												
Install Pilot Scale Infiltration Gallery/Backfill Area	16/Nov/94	3.00 d	19/Nov/94												
TSDF Approval	13/Dec/94	1.00 d	13/Dec/94												
Package & Ship Wastes/Sludges	14/Dec/94	4.00 d	19/Dec/94												
Inorganic Hot Spots	14/Sep/94	71.00 d	27/Dec/94												
Collect Waste Classification Samples	14/Sep/94	1.00 d	14/Sep/94												
Waste Classification Analytical Results	29/Sep/94	1.00 d	29/Sep/94												
Excavate and Stockpile/Backfill Hot Spots	14/Nov/94	3.00 d	16/Nov/94												
Waste Classification Sampling of Stockpiles	16/Nov/94	1.00 d	16/Nov/94												
Waste Classification Analytical Results	30/Nov/94	1.00 d	30/Nov/94												
Waste Profiles - Inorganic Solids to TSDF	02/Dec/94	1.00 d	02/Dec/94												
TSDF Approval for Inorganic Solids, Arrange for Disposal	16/Dec/94	1.00 d	16/Dec/94												
Metal Hot Spot Disposal	19/Dec/94	5.00 d	27/Dec/94												
PCB Area	09/May/95	46.00 d	13/Jul/95												
Set Up Soil Staging Area	09/May/95	2.00 d	10/May/95												
Install Soil Erosion/Sediment Controls	11/May/95	2.00 d	12/May/95												
Excavate, Segregate, and Stockpile Soils	15/May/95	9.00 d	25/May/95												
Post Excavation Sampling	25/May/95	1.00 d	25/May/95												
Post Excavation Analytical Results	01/Jun/95	1.00 d	01/Jun/95												
Backfill/Restoration	12/Jun/95	7.00 d	20/Jun/95												
Waste Characterization Sampling	26/May/95	1.00 d	26/May/95												
Waste Characterization Results	16/Jun/95	1.00 d	16/Jun/95												
Waste Profile TSDF	19/Jun/95	1.00 d	19/Jun/95												
TSDF Approval	05/Jul/95	1.00 d	05/Jul/95												
Package & Ship Wastes	10/Jul/95	4.00 d	13/Jul/95												

APPENDIX B
COST ESTIMATE

**REMEDIAL ACTION PLAN - HOT SPOT SOILS
PHASE I REMEDIATION - L.E. CARPENTER AND COMPANY**

Task Descriptions	Technical Approach/Cost Assumptions	Cost Estimate
1) Mobilization and Installation of Soil Erosion and Sediment Control Plan	Location and markout of underground utilities at the site in the proposed excavation areas. Preparation of site, including temporary removal of passive recovery system aboveground cables and tubing. Installation of necessary erosion and sediment controls, exclusive of PCB area.	\$8,000
2) Inorganic Hot Spots - Excavation and Disposal	Excavation, waste characterization, transportation and off site disposal (of 200 cubic yards) of soil contaminated with lead and antimony. Disposal cost based on disposal by landfilling, with transportation in roll-off containers or drum trailers.	\$145,000
3) Organic Hot Spots - Excavation and Disposal	Excavation, transportation and backfill (of 600 cubic yards) within excavated disposal area. Excavation, waste characterization, treatment, and disposal (of 330 cubic yards) of free-product containing soils (Hot Spot #6). Transportation by bulk roll-offs or dump trailers.	\$275,000
4) Disposal Area - Excavation and Disposal	Excavation, stockpiling, waste characterization, transportation, and disposal (of 300 cubic yards) of RCRA hazardous waste. Costs will be dependant upon the disposal method, which is dependant upon the waste characterization results.	\$275,000 to \$1,310,000
5) PCB Area - Excavation and Disposal	Excavation, stockpiling, waste characterization, transportation, and disposal (of 880 cubic yards) of PCB contaminated soils. Costs will be dependant upon the disposal method, which is dependant upon the waste characterization analytical results.	\$950,000 to \$2,366,000
6) Reporting	Preparation of the Remedial Action Summary Report for Hot Spot Soils - Phase I Remedial Action.	\$12,000

**REMEDIAL ACTION PLAN - GROUNDWATER PRE-DESIGN TESTING
PHASE I REMEDIATION - L.E. CARPENTER AND COMPANY**

Task Descriptions	Technical Approach/Cost Assumptions	Cost Estimate
1) Aquifer Pumping Tests	Monitoring background water level trends, two step-drawdown tests (three steps), two constant rate pumping tests, and two recovery tests for the shallow aquifer zones.	\$65,000
2) Infiltration Tests	Percolation testing in three locations, pilot scale infiltration testing, and injection testing in RW-3 and CW-2.	\$45,000
3) Numerical Modelling	Numerical, three-dimensional modelling (using MODFLOW) with pre- and post-processing, to aid in the design groundwater pumping/reinjection scheme for Phase II Remedial Action - Groundwater Treatment.	\$25,900
4) Well Abandonment	Abandonment/removal of 6 groundwater monitoring wells/well points.	\$11,000
5) Well Replacement/Installation	Closure/replacement of one well within areas of excavation, installation of seven new monitoring points (which includes one additional river point).	\$34,900
6) Groundwater and Floating Product Sampling	Groundwater sampling in selected wells for selected parameters, to aid in treatment system design. Sampling of floating product in selected wells on site.	\$57,800
7) Reporting	Preparation of the Remedial Action Summary Report.	\$12,000
8) Meeting	Meeting with regulatory agency.	\$6,700

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN



**DRAFT
QUALITY ASSURANCE PROJECT PLAN
FOR REMEDIAL ACTIONS TO BE CONDUCTED
AT THE L.E. CARPENTER SITE
WHARTON, NEW JERSEY**

**Prepared on behalf of L.E. CARPENTER AND COMPANY
for the New Jersey Department of Environmental Protection**

October 1994

W.O. No.: 06720-019-001

Prepared by:

**ROY F. WESTON, INC.
Raritan Plaza I, 4th Floor
Edison, New Jersey 08837**

QUALITY ASSURANCE PROJECT PLAN L.E. CARPENTER SITE

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1	INTRODUCTION	1-1
1.1	Project Scope	1-1
1.2	Project Data Quality Objectives	1-1
1.2.1	Accuracy	1-3
1.2.2	Precision	1-3
1.2.3	Completeness	1-3
1.2.4	Representativeness	1-4
1.2.5	Comparability	1-4
1.3	Project Organization	1-4
2	ANALYTICAL METHODS/QUALITY ASSURANCE	2-1
2.1	Laboratory Requirements	2-1
2.2	Soil Samples	2-1
2.2.1	Analytical Methods	2-1
2.2.2	Sample Handling and Preservation	2-5
2.2.3	Field and Laboratory Quality Control Samples	2-6
2.3	Groundwater Samples	2-6
2.3.1	Analytical Methods	2-6
2.3.2	Sample Handling and Preservation	2-9
2.3.3	Field and Laboratory Quality Control Samples	2-9
2.4	Light, Non-Aqueous Phase Liquid (LNAPL) Samples	2-10
2.4.1	Analytical Methods	2-10
2.4.2	Sample Handling and Preservation	2-10
2.4.3	Field and Laboratory Quality Control Samples	2-10
2.5	Waste Classification Samples	2-12
2.5.1	Analytical Methods	2-12
2.5.2	Sample Handling and Preservation	2-12
2.5.3	Field and Laboratory Quality Control Samples	2-15
2.6	Sample Labeling and Chain of Custody Procedures	2-15
2.7	Data Reporting	2-15

**QUALITY ASSURANCE PROJECT PLAN
L.E. CARPENTER SITE**

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
3	SAMPLING METHODS	3-1
3.1	Soil Sampling Procedures	3-1
3.2	Groundwater Sampling Procedures	3-2
3.3	Light, Non-Aqueous Phase Liquid(LNAPL) Sampling Procedures	3-3
3.4	Waste Classification Sampling Procedures	3-3
3.5	Field Screening Procedures	3-3
3.5.1	Field Portable X-Ray Fluorescence (XRF)	3-3
3.5.2	ENSYS Immunoassay Field Testing Kit	3-4
4	FIELD ACTIVITIES	4-1
4.1	Decontamination Procedures	4-1
4.2	Pumping Test Procedures	4-1
4.2.1	Development of Background Water Level Trends	4-1
4.2.2	Step Drawdown Test	4-1
4.2.3	Aquifer Pumping Test Methodologies	4-2
4.2.4	Recovery Test	4-2
4.2.5	Well Redevelopment	4-2
4.3	Percolation Test Procedures	4-3
4.4	Infiltration Test Procedures	4-3
4.5	Injection Test Procedures	4-3
4.6	Groundwater Modeling Procedures	4-3
4.7	Monitoring Well Installation Procedures	4-3
4.8	Monitoring Well Abandonment Procedures	4-4
4.9	Excavation Procedures	4-4

**QUALITY ASSURANCE PROJECT PLAN
L.E. CARPENTER SITE**

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
5	FIELD ANALYTICAL INSTRUMENTATION	5-1
5.1	Calibration Procedures	5-1
5.1.1	Specific Conductance Meter	5-1
5.1.2	pH Meter	5-1
5.1.3	Dissolved Oxygen Meter	5-2
5.1.4	HNu Photoionization Detector	5-2
5.1.5	Organic Vapor Meter	5-2
5.1.6	Organic Vapor Analyzer (OVA)	5-2
5.1.7	Field Portable X-Ray Fluorescence (XRF)	5-3
5.1.8	ENSYS Immunoassay Field Testing Kit	5-3
5.2	Preventative Maintenance Procedures	5-3

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
1-1	Phase I Area of Concern	1-2
1-2	Phase I Project Organization	1-5
2-1	Soil Sampling Analytical Methods	2-2
2-2	Soil Sample Frequency	2-3
2-3	Groundwater Sample Analytical Methods	2-7
2-4	Groundwater Sample Frequency	2-8
2-5	LNAPL Sample Analytical Methods and Frequency	2-11
2-6	Waste Classification Sample Analytical Methods	2-13
2-7	Waste Classification Sample Frequency	2-14

SECTION 1

INTRODUCTION

1.1 PROJECT SCOPE

The L.E. Carpenter facility is located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey and occupies approximately 14.6 acres. The L.E. Carpenter facility operated as a manufacturing facility for vinyl wall coverings from 1943 to 1987. It is currently utilized as subleased warehouse space and light manufacturing.

Various field efforts, including a remedial investigation (RI), have been completed to characterize the site and address primary sources of contamination. A summary of these field efforts is provided as Section 2 of the Phase I Remedial Action Workplan. Secondary sources of contamination remain at the site, which include an immiscible product layer floating on groundwater, localized areas of contaminated soil, a former disposal area, and contaminated groundwater. The Phase I Remedial Action Workplan addresses localized areas of contaminated soil at the site and additional data collection requirements. The localized areas of contaminated soil at the site were identified as "hotspots" during the RI and were further delineated during post-RI investigations. The contaminants of concern for the Phase I areas of concern are summarized in Table 1-1.

This Quality Assurance Project Plan (QAPP) summarizes the quality assurance/quality control (QA/QC) procedures that will be incorporated into the Remedial Action activities planned for the L.E. Carpenter site. Procedures in the QAPP identify proper sample collection, handling, and laboratory protocols to be used throughout all Remedial Action activities. Phase I Remedial Action field activities are also described in the QAPP.

1.2 PROJECT DATA QUALITY OBJECTIVES

The overall data quality objective for field activities, data analyses, and laboratory analyses is to produce data of sufficient and known quality to support remedial design and to confirm the effectiveness of planned remedial activities. Specifically, all data will be gathered or developed using procedures appropriate for the intended use. Standard procedures will be used so that known and acceptable levels of accuracy, precision, representativeness, completeness and compatibility are maintained. Descriptions of these criteria are presented in the following subsections.

TABLE 1-1

**PHASE I AREA OF CONCERNS
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Area of Concern	Contaminant of Concern
Inorganic Hot Spots⁽¹⁾:	
Hot Spot "A"	Antimony
Hot Spot "B"	Lead
Hot Spot "C"	Antimony, Lead
Hot Spot "D"	Antimony, Lead
DEHP/Organic Hot Spots:	
Hot Spot "1"	Bis(2-Ethylhexyl)phthalate (DEHP)
Hot Spot "2"	DEHP, Butylbenzyl phthalate
Hot Spot "3"	DEHP
Hot Spot "4"	DEHP
Hot Spot "5"	DEHP
Hot Spot "6"	Xylenes
Disposal Area:	Ethylbenzene, Xylenes, Methylene Chloride, DEHP, Antimony, Lead
PCB Contaminated Area:	PCB, DEHP

Note:

- (1) - Inorganic Hot Spot "E" is located within the disposal area and will be addressed by the disposal area remedial activities.

1.2.1 Accuracy

Accuracy is the degree of agreement of a measurement, with an accepted reference or true value, usually expressed as the difference between the two values, or the difference as a percentage of the reference or the true value. It is sometimes expressed as a percentage of the reference. For this project, accuracy will be expressed as the percentage of the reference. Accuracy is a measure of the bias of a system.

Analytical accuracy is expressed as the percentage recovery of an analyte which has been added to the sample or matrix standard (i.e., matrix spike, blank) at a known concentration before analysis.

Accuracy of all field screening methods will be confirmed by sending representative analytical samples for laboratory confirmation of the field screening result.

1.2.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

During collection of data using field methods and/or instruments, precision is checked by reporting measurements at one location and comparing results. For example, water level measurements would be taken three times at a well and the values compared. Only if the values are within a specified percentage of each other are the measurements considered sufficiently precise.

Analytical precision is calculated by expressing as a percentage the difference between results of analyses of duplicate samples for a given analyte.

1.2.3 Completeness

Data completeness for this project is defined as the percent of acceptable data obtained compared to those planned for the project. Unless recommended for rejection as the result of data validation, qualified data is considered valid, useable data and therefore acceptable. The level of completeness can be affected by field conditions as well as laboratory factors.

Field data completeness can be affected by inaccessibility to various areas and/or media, along with unanticipated difficulties with sample collection. For example, minimal thickness of floating product in on-site monitoring wells may reduce the number of light, non-aqueous phase liquid (LNAPL) samples collected. A seasonally low water table at a monitoring well may prevent collection of the required sample volume needed for sample analysis. Laboratory data

completeness can be affected by difficulties encountered during sample handling, as well as unforeseen complications with respect to sample analysis or extraction.

The overall completeness goal for sampling activities associated with remedial actions at the L.E. Carpenter facility is 85 percent, including difficulties from both field and laboratory sources. Certain data points will be defined as critical to the remedial actions. Critical data points are sample locations for which valid data must be obtained to support groundwater remedial design. An example of a critical data point may be water quality parameters for groundwater samples collected from pumping monitoring wells during the aquifer pumping tests. The completeness goal for the critical data points is 100 percent.

1.2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, variation at a sampling point or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. To ensure that the samples obtained in the field represent the particular environment from which they are collected, field sampling and laboratory analysis will be performed in accordance with NJDEP's *Field Sampling Procedure Manual* (May 1992) and the Technical Requirements for Site Remediation (N.J.A.C. 7:26E-1 et seq.).

1.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal will be achieved by using standard techniques to collect and analyze representative samples and by reporting analytical results in appropriate units.

1.3 PROJECT ORGANIZATION

Table 1-2 summarizes the L.E. Carpenter Phase I Remedial Action project organization as required by N.J.A.C. 7:26E-2.2. It should be noted that the name(s) and telephone number(s) of the individual(s) responsible for laboratory activities will be designated following laboratory(s) identification.



TABLE 1-2

**PHASE 1 PROJECT ORGANIZATION
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Task	Name - Affiliation	Telephone Number
Overall Project Coordination	Mr. Christopher Anderson - LEC Mr. Martin O'Neill - WESTON	(216) 589-4020 (908) 417-5830
Sampling Activities, including Quality Assurance and Quality Control	Field Coordinator - WESTON	(908) 417-5800
Laboratory Activities, including Quality Assurance and Quality Control	To be identified ⁽¹⁾	To be identified ⁽¹⁾

Note:

- (1) - Name(s) and telephone number(s) of the individual(s) responsible for laboratory activities will be designated following laboratory(s) identification.

SECTION 2

ANALYTICAL METHODS/QUALITY ASSURANCE

In order to generate analytical data of known and defensible quality, adherence to established quality assurance protocols will be used. To ensure that the samples obtained in the field represent the particular environment from which they are collected and are of satisfactory quality, field sampling and laboratory analysis will be performed in accordance with NJDEP's *Field Sampling Procedure Manual* (May 1992) and the Technical Requirements for Site Remediation (N.J.A.C. 7:26E-1 et seq.).

2.1 LABORATORY REQUIREMENTS

Environmental samples for all parameters for which analysis will be performed and for which certification exists will be analyzed by a New Jersey certified laboratory in good standing in accordance with N.J.A.C. 7:26E-2.1. The laboratory shall follow all quality assurance and quality control (QA/QC) procedures specified by the analytical methods. Analytical results shall meet the method detection limits specified by the analytical methods.

The analytical laboratory shall follow internal chain of custody (COC) procedures associated with sample receipt, storage, preparation, analysis and general security procedures. Upon sample receipt, the sample custodian will inspect the integrity of the sample containers. The presence of broken or leaking samples will be noted on the COC record. The sample custodian will sign (with date and time of receipt) the COC record, thus assuming custody of the samples. The sample custodian will also check the information on the COC record against the sample labels. Any inconsistencies will be resolved with the sampling representative before sample analysis proceeds. After sample receipt, all analytical samples will be stored in a locked sample refrigerator pending sample analysis and preparation. The storage refrigerators are maintained at approximately 4°C.

2.2 SOIL SAMPLES

2.2.1 Analytical Methods

Table 2-1 summarizes the analytical methods to be used and associated sample container requirements, preservation methods and maximum holding times for post-excavation soil samples to be collected during remedial actions at the L.E. Carpenter facility. A summary of post-excavation soil sample and required quality assurance sample collection frequencies is presented in Table 2-2. Samples will be analyzed only for the contaminant(s) of concern associated with the individual area of concern (as identified in Table 1-1). All post-excavation sampling will be conducted within two weeks of excavation.

TABLE 2-1

SOIL SAMPLE ANALYTICAL METHODS
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN

Matrix	Analytical Parameter	Analytical Method	Sample Container Type	Preservation Method	Maximum Holding Time
Soil	Xylenes	8020 (1)	Glass, teflon-lined cap	Cool 4 deg C	14 days
	DEHP, butylbenzyl phthalate	8270 (1)	Glass, teflon-lined cap	Cool 4 deg C	14 days
	PCB	8080 (1)	Glass, teflon-lined cap	Cool 4 deg C	14 days
	Antimony	6010 (1)	Glass or Polyethylene	Cool 4 deg C	14 days
	Lead	6010 (1)	Glass or Polyethylene	Cool 4 deg C	14 days

Note:

(1) USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition.

TABLE 2-2

SOIL SAMPLE FREQUENCY
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN

Matrix	Analytical Parameter	Analytical Method	Number of Samples	Number of Field Blanks	Number of Trip Blanks	Number of Duplicate Samples
Soil	Xylenes	8020 (1)	To be determined based on excavation size, contaminant of concern and contamination origin (see text).	One per day	Not required for non-aqueous samples.	5 percent of total number of soil samples collected per analyte.
	DEHP, butylbenzyl phthalate	8270 (1)				
	PCB	8080 (1)				
	Antimony	6010 (1)				
	Lead	6010 (1)				

Note:

(1) USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition.

Frequency of collection of post-excavation soil samples will be in accordance with N.J.A.C. 7:26E-6.4. For excavations 20 to 300 feet in perimeter, the following sampling frequencies will be used:

- For surface spills (inorganic hotspots A, B, C and D; DEHP/organic hotspots 3, 4 and 5), one sample will be collected from the top of each sidewall for every 30 linear feet of sidewall and one sample will be collected from the excavation bottom for every 900 square feet of excavation.
- For subsurface spills (DEHP/organic hotspots 1, 2 and 6), one sample will be collected from the bottom of each sidewall for every 30 linear feet of sidewall and one sample will be collected from the excavation bottom for every 900 square feet of excavation.

For excavations greater than 300 feet in perimeter (PCB contaminated soil area), one sample will be collected from the excavation bottom for every 900 square feet of excavation. Sidewall samples are not proposed for the PCB contaminated soil area as PCB delineation sampling (December 1993) previously determined the extent of excavation required.

Additional information for the aforementioned areas of concern is provided below:

Inorganic Hotspots - Field screening methods (X-Ray Fluorescence (XRF)) will be used to screen for antimony and lead during inorganic hotspot remediation. A Spectrase 9000® XRF meter, or equivalent, with a remote probe will be used. The Spectrase 9000® has a resolution sufficient to provide QA II data. The XRF results will be used to direct the excavation activities to ensure that contamination above site specific cleanup goals is removed and to minimize the volume of excavated materials. Post-excavation samples will be collected at the frequency described above.

DEHP/Organic Hotspots - Tank closure activities, including soil excavation and backfilling with clean fill, have occurred in the immediate location of Hotspot #2 since completion of the RI sampling. Three soil boring samples will be collected (in the area identified in the RI as exceeding soil cleanup criteria) from the interval of 5 feet to 5.5 feet below ground surface (BGS) and analyzed for DEHP and butylbenzyl phthalate to determine whether previously identified contamination still remains. If analytical results indicate that contaminated soils were remediated by the tank closure activities, no further action will be required at DEHP/organic Hot spot #2. If contaminated soils were DEHP/organic hotspot 2 will be remediated and post-excavation samples will be collected with the frequency described above.

For DEHP/organic hotspot 6, xylene samples collected within 24 hours of the excavation will be collected from the 0 to 6 inch interval beneath the excavation bottom. Xylene samples collected after 24 hours of the excavation will be collected from the 6 to 12 inch interval beneath

the excavation bottom. For all DEHP/organic hotspots, post-excavation samples will be collected at the frequency described above.

Disposal Area - Post-excavation sampling for organic constituents will not be performed for this hotspot, since it is an area in which bioremediation will occur during Phase II (Stage II) remedial action. Post-excavation soil samples collected from the Disposal Area (including inorganic hotspot E) will be limited to the parameters of antimony and lead. Field screening methods (XRF meter) will be used to direct the extent of excavation, based on lead and antimony concentrations in the underlying soils.

A reduced sampling frequency (per N.J.A.C. 7:26E-6.4(a)2.iii) will be used for the post-excavation samples, since the disposal area has a perimeter greater than 300 linear feet. One perimeter sample will be collected from the bottom of the excavation sidewalls for every 60 linear feet, or six perimeter samples total. One excavation bottom sample will be collected for every 1700 square feet, or 5 bottom samples total.

PCB Contaminated Soil Area - Field screening methods (PCB test kits) will be used to screen for Aroclor 1254 during the PCB area remediation. The PCB test kits will be used to direct the depth of excavation activities to ensure all contamination is removed and to minimize the volume of excavated soil. The maximum depth of excavation associated with the PCB contaminated soils is 2 feet BGS.

A reduced sampling frequency (per N.J.A.C. 7:26E-6.4(a)2.iii) will be used for the post-excavation samples, since the PCB area has a perimeter greater than 300 linear feet. A total of six perimeter samples will be collected from the top of the sidewall and nine bottom samples will be collected from the floor of the excavation.

Additional samples will be collected from a portion of the excavation. The additional samples will be analyzed for DEHP. The area of potential DEHP concern is estimated as 6,900 square feet, with a 325 linear feet perimeter. Per N.J.A.C. 7:26E-6.4(a)2.iii, a reduced sampling frequency will be used. A total of five sidewall samples and five excavation bottom samples will be collected for DEHP analysis from the area of potential DEHP concern. If the post-excavation samples indicate DEHP remains at concentrations greater than the site specific cleanup criteria, additional soil will be excavated (to maximum depth of static groundwater) and additional samples will be collected at the same reduced frequency.

2.2.2 Sample Handling and Preservation

Soil samples will be collected by removing the soil from the sampling device and transferring the soil into laboratory cleaned jars. Samples to be collected for volatiles analysis will be immediately placed into the sample bottle without mixing. All soil samples for non-volatiles analysis will be homogenized prior to being placed in the sample container.

The type and size of the jars will match the intended analytical procedure. Soil samples will then be labeled and placed into a cooler filled with ice. The coolers will be maintained at approximately 4 °C with ice through transport to the laboratory. Upon arrival at the laboratory, the samples will be transferred from the coolers to a refrigerator pending analysis.

Samples will be submitted to the analytical laboratory no later than 48 hours after sample collection. For all samples, the time between sample collection and analysis will conform with the respective sample holding time specified by the analytical method.

2.2.3 Field and Laboratory Quality Control Samples

Field Blanks - Field blanks will be collected at the rate of one per day, as required by NJDEP's *Field Sampling Procedures Manual*. Field blanks will be obtained by pouring analyte-free water, supplied by the laboratory, or field decontaminated sampling device. Field blank samples will be placed in the ice-filled coolers along with the environmental samples for transport to the laboratory. Field blanks will be preserved as specified for the analytical methodology. Where field equipment has been laboratory decontaminated and is dedicated to a sampling location, field blanks will not be required.

Trip Blanks - NJDEP's *Field Sampling Procedures Manual* does not require trip blanks for soil (non-aqueous) samples.

Duplicates - Duplicate soil samples will be collected at a rate of 5 percent of the total number of soil samples collected per analyte throughout the project, as required by NJDEP's *Field Sampling Procedures Manual*. Duplicate samples will be submitted to the laboratory as "blind" samples.

2.3 GROUNDWATER SAMPLES

2.3.1 Analytical Methods

Table 2-3 summarizes the analytical methods to be used and associated sample container requirements, preservation methods and maximum holding times for groundwater samples to be collected during remedial actions at the L.E. Carpenter facility. A summary of groundwater and quality assurance sample frequencies is presented in Table 2-4.

Groundwater samples will be collected and analyzed for volatile organics plus xylenes, DEHP, antimony, lead and water quality indicator parameters, as indicated in the Remedial Action Workplan. Groundwater samples from newly installed monitoring wells will be collected a minimum of two weeks after installation. These samples will be analyzed for volatile organics plus xylenes, DEHP, antimony, lead and water quality indicator parameters. In addition, groundwater samples will be collected from selected monitoring wells, as indicated in the

TABLE 2-3

**GROUNDWATER SAMPLE ANALYTICAL METHODS
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Matrix	Analytical Parameter	Analytical Method	Sample Container Type	Preservation Method	Maximum Holding Time
Water	Volatile Organics + Xylenes	624 (1)	Glass, teflon-lined septum	Cool 4 deg C, HCl to pH 2	14 days
	Base/Neutral/Acid Extractables	625 (1)	Amber glass, teflon-lined cap	Cool 4 deg C	7 days (3)
	Total Hardness	130.1 (2)	Glass or Polyethylene	H ₂ SO ₄ or HNO ₃ to pH < 2	6 months
	Iron	236.1 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Sodium	273.1 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Total Alkalinity	310.1 (2)	Glass or Polyethylene	Cool 4 deg C	14 days
	Chlorides	325.3 (2)	Glass or Polyethylene	None required	28 days
	Sulfates	375.1 (2)	Glass or Polyethylene	Cool 4 deg C	28 days
	Total Dissolved Solids	160.1 (2)	Glass or Polyethylene	Cool 4 deg C	7 days
	Total Suspended Solids	160.2 (2)	Glass or Polyethylene	Cool 4 deg C	7 days
	Turbidity	180.1 (2)	Glass or Polyethylene	Cool 4 deg C	48 hours
	Color	110.1 (2)	Glass or Polyethylene	Cool 4 deg C	48 hours
	Chemical Oxygen Demand	410.1 (2)	Glass or Polyethylene	Cool 4 deg C, H ₂ SO ₄ to pH < 2	28 days
	Biological Oxygen Demand	405.1 (2)	Glass or Polyethylene	Cool 4 deg C	48 hours
	Total Organic Carbon	415.1 (2)	Glass or Polyethylene	Cool 4 deg C, HCl or H ₂ SO ₄ to pH < 2	28 days
	Manganese	243.1 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Antimony	204.1 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Arsenic	206.5 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Lead	239.1 (2)	Glass or Polyethylene	HNO ₃ to pH < 2	6 months
	Total Kjeldahl Nitrogen	351.4 (2)	Glass	Cool 4 deg C, H ₂ SO ₄ to pH < 2	28 days
	Nitrate Nitrogen	353.1 (2)	Polyethylene	Cool 4 deg C, H ₂ SO ₄ to pH < 2	28 days
	Nitrite Nitrogen	353.1 (2)	Polyethylene	Cool 4 deg C	48 hours
	Phosphate	365.2 (2)	Polyethylene	Cool 4 deg C, H ₂ SO ₄ to pH < 2	28 days
	Bicarbonate	310 (2)	Polyethylene	Cool 4 deg C	14 days
	Calcium, Magnesium	200.7 (2)	Polyethylene	Cool 4 deg C, HNO ₃ to pH < 2	6 months
	pH	150.1 (2)	Glass	Cool 4 deg C	24 hours

Notes:

- (1) Federal Register 40 CFR Part 136, Vol. 49, No. 209, Test Parameters for the Analysis of Pollutants.
- (2) USEPA-800/4-79-020, Methods for Chemical Analysis of Water and Waste.
- (3) Holding time is 7 days until extraction, 40 days after extraction.

TABLE 2-4

**GROUNDWATER SAMPLE FREQUENCY
L. E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Matrix	Analytical Parameter	Analytical Method	Number of Samples	Number of Field Blanks	Number of Trip Blanks	Number of Duplicate Samples
Water	Volatile Organics + Xylenes	624 (1)	– One round from select, existing monitoring wells.	1 per sampling day/event.	1 per sample shipment for volatile organics analysis.	5 percent of total number of samples collected per analyte.
	Base/Neutral/Acid Extractables	625 (1)				
	Total Hardness	130.1 (2)				
	Iron	236.1 (2)	– One round from monitoring wells to be installed (with the exception of indicator parameters in well MW–13(R))			
	Sodium	273.1 (2)				
	Total Alkalinity	310.1 (2)				
	Chlorides	325.3 (2)				
	Sulfates	375.1 (2)				
	Total Dissolved Solids	160.1 (2)				
	Total Suspended Solids	160.2 (2)				
	Turbidity	180.1 (2)				
	Color	110.1 (2)				
	Chemical Oxygen Demand	410.1 (2)				
	Biological Oxygen Demand	405.1 (2)				
	Total Organic Carbon	415.1 (2)				
	Manganese	243.1 (2)				
	Antimony	204.1 (2)				
	Arsenic	206.5 (2)				
	Lead	239.1 (2)				
	Total Kjeldahl Nitrogen	351.4 (2)				
	Nitrate Nitrogen	353.1 (2)				
	Nitrite Nitrogen	353.1 (2)				
	Phosphate	365.2 (2)				
	Bicarbonate	310 (2)				
	Calcium, Magnesium	200.7 (2)				
	pH	150.1 (2)				

Notes:

- (1) Federal Register 40 CFR Part 136, Vol. 49, No. 209, Test Parameters for the Analysis of Pollutants.
- (2) USEPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes.
- (3) Only those samples collected during the aquifer pumping tests will be analyzed for full Base/Neutral/Acid extractables analysis. All other samples will be analyzed for DEHP by Method 625.

Remedial Action Workplan, and analyzed for the same suite of analytes as the samples collected from the pumping well.

Two rounds of groundwater samples will be collected from the pumping monitoring wells during the aquifer pumping tests. The aquifer pumping test groundwater samples will be collected at the beginning and end of the test, and analyzed for volatile organics plus xylenes, full base/neutral/acid extractables, antimony, lead, arsenic and water quality indicator parameters.

2.3.2 Sample Handling and Preservation

Monitoring wells will be purged of three well volumes prior to sampling. Groundwater samples will be collected by lowering the bailer into the well slowly, in order to minimize the potential for aeration of the groundwater to be sampled. Groundwater samples will be transferred from the bailer directly into the sample bottle. Groundwater samples collecting during the aquifer pumping tests will be collected from the pump discharge. The following order of sample bottle filling will be used when collecting groundwater samples:

- 1). Volatile organics plus xylenes
- 2). Total organic carbon
- 3). Base/Neutral/Acid extractables
- 4). Total metals
- 5). Sulfate and chloride
- 6). Preserved inorganics
- 7). Non-preserved inorganics

Groundwater samples will be preserved as specified by the analytical method, labeled and placed in a cooler filled with ice. The samples will be maintained at approximately 4 °C with ice through transport to the laboratory. At the laboratory, the samples will be transferred to a refrigerator pending analysis.

Samples will be submitted to the analytical laboratory no later than 48 hours after sample collection. For all samples, the time between sample collection and analysis will conform with the respective sample holding time specified by the analytical method.

2.3.3 Field and Laboratory Quality Control Samples

Field Blanks - Field blanks will be collected at a rate of 1 field blank per day of groundwater sampling throughout the project, as required by NJDEP's *Field Sampling Procedures Manual*. Field blanks will be obtained by pouring analyte-free water, supplied by the laboratory, over a dedicated or field decontaminated sampling device. Field blank samples will be placed in the ice-filled coolers along with the environmental samples for transport to the laboratory. Field blanks will be preserved as specified for the analytical methodology.

Trip Blanks - A trip blank will be included with each shipment of groundwater samples for volatile organics plus xylenes analysis throughout the project, as required by the NJDEP's *Field Sampling Procedures Manual*. The trip blanks will be provided by the laboratory in sealed 40-milliliter vials and will be shipped with the empty sample bottles. The trip blanks will be placed in the ice-filled coolers along with the environmental samples for transport to the laboratory. Trip blanks will be preserved by the laboratory as required by the analytical methodology.

Duplicates - Duplicate samples will be collected at a rate of 5 percent of the total number of groundwater samples collected per analyte throughout the project, as required by NJDEP's *Field Sampling Procedures Manual*. Duplicate samples will be submitted to the laboratory as "blind" samples.

2.4 LIGHT, NON-AQUEOUS PHASE LIQUID (LNAPL) SAMPLES

2.4.1 Analytical Methods

During collection of groundwater samples from the existing monitoring wells and newly installed monitoring wells, light, non-aqueous phase liquid (LNAPL) samples will be collected from all wells in which LNAPL is determined to be present in sufficient quantity to sample. LNAPL samples will be analyzed by gas chromatographic fingerprint by analytical Methods 8240 and 8270 (Test Parameters for the Analysis of Pollutants, 40 CFR 136), respectively. Table 2-5 summarizes the required quality assurance information for these analytical methods. In addition, the laboratory will analyze for the specific gravity of the LNAPL samples.

2.4.2 Sample Handling and Preservation

LNAPL samples will be collected from wells identified in the Work Plan if sufficient product is present. LNAPL samples will be collected by lowering the bailer into the well slowly and just through the LNAPL layer, in order to minimize the potential for transporting the floating product into the underlying groundwater. LNAPL samples will be transferred directly from the bailer into the sample bottle.

LNAPL samples will be labeled and placed in a cooler filled with ice. The samples will be maintained at approximately 4 °C with ice through transport to the laboratory. At the laboratory, the samples will be transferred to a refrigerator pending analysis.

Samples will be submitted to the analytical laboratory no later than 48 hours after sample collection. For all samples, the time between sample collection and analysis will conform with the respective sample holding time specified by the analytical method.

2.4.3 Field and Laboratory Quality Control Samples

Field blanks, trip blanks and duplicate samples will not be collected for LNAPL samples.

TABLE 2-5

**LNAPL SAMPLE ANALYTICAL METHODS AND FREQUENCY
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Analytical Parameter	Volatile Organic and Xylenes	Base Neutral/Acid Extractables
Analytical Method	8240 ⁽¹⁾	8270 ⁽¹⁾
Sample Container Type	Glass, teflon-lined cap	Glass, teflon-lined cap
Preservation Method	Cool 4°C	Cool 4°C
Maximum Holding Time	14 days	14 days
Number of Samples	One round from selected wells with sufficient product thickness	One round from selected wells with sufficient product thickness
Number of Field Blanks	None	None
Number of Trip Blanks	None	None
Number of Duplicate Samples	None	None

Note:

- ⁽¹⁾ - USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition.

2.5 WASTE CLASSIFICATION SAMPLES

2.5.1 Analytical Methods

Table 2-6 summarizes the analytical methods to be used and associated quality assurance information for waste classification samples to be collected during remedial actions at the L.E. Carpenter facility. A summary of waste classification sample and required quality assurance sample collection frequencies is presented in Table 2-7.

Frequency of collection of waste classification samples will be based on NJDEP's Waste Classification Guidance Document. The inorganic hotspot soils will be combined for disposal. Waste classification samples for the inorganic hotspots, disposal area and PCB contaminated soils will be collected separately. All areas are anticipated to be less than 900 cubic yards in volume, hence one waste classification sample will be collected for every 20 cubic yards of volume. Prior to sampling, the waste will be divided into grids representing no more than 20 cubic yards of waste. One waste classification sample will then be collected from each grid. Since excavated soils from inorganic hotspot and PCB contaminated soil remediation are anticipated to be relatively homogeneous, 5 adjacent grid samples will be composited on a equal weight basis at the analytical laboratory to create an "area composite" for analysis. This procedure may also be performed for the disposal area if the excavated waste appears to be homogeneous. If any of the waste is not relatively homogeneous upon excavation, "area composites" will not be used and all collected samples will be analyzed.

If the excavated volume of the PCB contaminated soils should exceed 900 cubic yards, the waste will be divided into 45 equal grids. "Grid composite" samples will be collected by taking 1 sample for every 20 cubic yards of waste within the grid and compositing them. If the excavated soils are relatively homogeneous, 5 adjacent "grid composite" samples will be composited on a equal weight basis at the analytical laboratory to create an "area composite" for analysis.

2.5.2 Sample Handling and Preservation

Waste classification samples from the disposal and PCB areas will be collected from the stockpile in accordance with sampling procedures identified in NJDEP's *Field Sampling Procedure Manual*, (May 1992). The stockpiles will be divided into grids of 20 cubic yards. One waste classification grid sample will be collected, using hand auger and trowel sampling techniques from each 20 cubic yard grid. The laboratory will composite the grid samples into area composites, and analyze the composite samples for the parameters presented in Tables 2-6.

Waste classification samples for the inorganic hotspot soils will be collected from the backhoe bucket using a decontaminated sampling device and transferred into laboratory cleaned jars. Samples will be homogenized in a stainless steel bowl and subsequently placed into the sample bottle.

TABLE 2 - 6

**WASTE CLASSIFICATION SAMPLE ANALYTICAL METHODS
L. E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Matrix	Analytical Parameter	Analytical Method	Sample Container Type	Preservation Method	Maximum Holding Time
Soil - Sludge	TCLP Metals	1311 (1)	Glass	Cool 4 deg C	14 days
	Full TCLP Analysis (2)	1311 (1)	Glass, teflon-lined septum	Cool 4 deg C	14 days
	Reactivity (Cyanide/Sulfide) (3)	Sec. 2 (1)	Amber Glass	Cool 4 deg C	14 days
	TPHC (4)	418.1 (1)	Glass	Cool 4 deg C	14 days
	Total PCBs (3)	8080 (1)	Glass, teflon-lined septum	Cool 4 deg C	14 days
	Ignitability (5)	1010 (1)	Amber Glass	Cool 4 deg C	14 days
	Corrosivity (6)	1110 (1)	Polyethylene	Cool 4 deg C	14 days
	PCB (7)	8080 (1)	Glass, teflon-lined septum	Cool 4 deg C	14 days

Notes:

- (1) USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition.
- (2) To be completed for 10 percent of the samples if generator certification is completed.
- (3) To be completed for 10 percent of the samples if generator certification is completed, however, required for all disposal area samples.
- (4) If TPHC exceeds 10,000 ppm, and the source and type of petroleum compound(s) is not known, an EPA Priority Pollutant scan must be performed.
- (5) If the waste contains liquids as defined by the analytical method, flash point criteria must also be performed.
- (6) To be performed only if the waste contains liquids as defined by the analytical method.
- (7) To be performed only for PCB contaminated soils area.

TABLE 2-7

**WASTE CLASSIFICATION SAMPLE FREQUENCY
L.E. CARPENTER REMEDIAL ACTION
QUALITY ASSURANCE PROJECT PLAN**

Matrix	Analytical Parameter	Analytical Method	Number of Samples
Soil - Sludge	TCLP Metals	1311 (1)	Collect 1 sample per 20 cubic yards of volume (2).
	Full TCLP Analysis	1311 (1)	
	Reactivity (Cyanide/Sulfide)	Sec. 2 (1)	
	TPHC	418.1 (1)	
	Total PCBs	8080 (1)	
	Ignitability	1010 (1)	
	Corrosivity	1110 (1)	
	PCB	8080 (1)	

Notes:

- (1) USEPA SW 846, Test Methods for Evaluating Solid Waste, Third Edition.
- (2) If excavated materials appear homogeneous, 5 adjacent grid samples will be composited at the laboratory to create an "area composite" for analysis.
- (3) Collect 2 additional sample volumes from every tenth sample for MS/MSD analysis.

The type and size of the jars will match the intended analytical procedure. Waste classification samples will then be labeled and placed into a cooler filled with ice. The coolers will be maintained at approximately 4 °C with ice through transport to the laboratory. Upon arrival at the laboratory, the samples will be transferred from the coolers to a refrigerator pending analysis. Samples will be submitted to the analytical laboratory no later than 48 hours after sample collection. For all samples, the time between sample collection and analysis will conform with the respective sample holding time specified by the analytical method.

2.5.3 Field and Laboratory Quality Control Samples

Field blanks, trip blanks, duplicate samples and matrix spike/matrix duplicate samples are not proposed for waste classification samples.

2.6 SAMPLE LABELING AND CHAIN OF CUSTODY PROCEDURES

All analytical samples will be identified with a label attached directly to the sample container. Sample labels will be completed using waterproof ink. The labels will contain the following information:

- Sample identification number.
- Time and date of collection.
- Project name.
- Parameters to be analyzed.
- Preservative, if applicable.
- Sampler's initials.

To maintain a record of sample collection, sample transfer between personnel, sample shipment and receipt by the laboratory, a chain-of-custody (COC) record will be filled out for each sample collected. Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples as well as the date and time will be documented. Prior to shipment of samples, the COC will be signed and dated by a WESTON field team member who has verified that those samples indicated on the COC are being shipped. The COC will be placed in the cooler along with the analytical samples shipped to the laboratory. The coolers will be sealed with a custody seal and strapping tape prior to shipment.

2.7 DATA REPORTING

Laboratory data deliverables shall consist of NJDEP reduced laboratory data deliverables, unless otherwise specified by the analytical method. All solid sample analyses shall be reported on a dry weight basis, except if otherwise required by the analytical method.

SECTION 3.0

SAMPLING METHODS

The following section describes the methods which will be used to collect soil, groundwater, LNAPL and waste classification samples during remedial action activities at the L.E. Carpenter facility. All sampling will be performed in accordance with N.J.A.C. 7:26E-1 et seq. and NJDEP's *Field Sampling Procedures Manual*. In addition, lead, antimony and PCB field screening procedures are outlined.

3.1 SOIL SAMPLING PROCEDURES

Post-excavation soil samples for non-volatiles analysis from excavations less than 4 feet in depth will be collected from the top 6 inches of the floor of the excavation and the excavation sidewalls using a decontaminated trowel or hand auger. Post-excavation soil samples for volatiles analysis (xylenes) collected within 24 hours of the excavation will be collected from the 0 to 6 inch interval beneath the excavation bottom. Volatiles samples collected after 24 hours of the excavation but within 2 weeks of the excavation, will be collected from the 6 to 12 inch interval beneath the excavation bottom.

Post-excavation soil samples from excavations greater than 4 feet in depth will be collected using a backhoe. Soil samples will be collected directly from the bucket of the backhoe using a decontaminated trowel and transferred into the sample bottle.

Soil boring samples will be collected using a decontaminated sampling device (i.e., split spoon) advanced by the drill rig. Upon retrieval, the split spoon will be opened, its contents logged and the sample transferred into the sample bottle. Should soil boring samples be collected for volatile organics analysis, the split spoon contents will be field screened using either a photoionization (PID) or flame ionization (FID) detector.

As required by NJDEP's *Field Sampling Procedures Manual*, all soil samples except those designated for volatile organics analysis, will be homogenized either in-situ or in a stainless steel bowl prior to being placed in the sample bottle. Soil samples for volatile organics analysis will be transferred directly into the sample bottle without mixing. Soil samples for volatile organics analysis will be packed tightly and be free of rocks and vegetation.

For duplicate samples, adequate sample will be collected at one time to fill the necessary sample bottles. Duplicate samples, except those designated for volatile organics analysis, will be homogenized in a stainless steel bowl and equally divided to fill the required sample bottles. Duplicate samples for volatile organics analysis will not be composited, but immediately transferred into the sample bottles.

All sample bottles will be laboratory prepared. Soil samples will be handled in accordance with the applicable analytical method.

3.2 GROUNDWATER SAMPLING PROCEDURES

Groundwater samples will be collected from selected, existing locations within the monitoring well network onsite. In addition, groundwater samples will be collected from newly installed monitoring wells on-site. The newly installed monitoring wells will be sampled a minimum of two weeks after development.

To ensure that a representative groundwater sample is collected, the monitoring wells will be sampled following the procedures outlined in the NJDEP *Field Sampling Procedures Manual* (May 1992), including:

- A depth-to-water reading (including measurement of any product) using a clean oil/water interface probe. The depth to water and total depth of the well will be used to calculate the well volume.
- Three well volumes will be purged (unless the well is purged dry after one volume) using a submersible pump with dedicated polyethylene tubing. During purging, pH, specific conductivity, dissolved oxygen and temperature will be measured and recorded for each volume.
- After sufficient recovery (within 2 feet of original depth to water or before 2 hours elapsed), the wells will be sampled using a laboratory-cleaned, dedicated teflon bailer with a dedicated, 5-foot, teflon-coated, stainless steel leader and dedicated polyethylene rope.
- The samples will be placed in a cooler with ice immediately after collection and transported to the laboratory. Sample chain-of-custody will be maintained throughout the sampling effort.

Elsewhere, groundwater samples will be collected during the aquifer pumping tests to be conducted on-site. Two groundwater samples will be collected from the pumping wells during the test. The first sample will be collected one hour into the aquifer pumping test and the other approximately one half hour prior to turning the pump off. Aquifer pumping test groundwater samples will be collected directly from the pump discharge.

All samples will be analyzed by a NJDEP certified laboratory for the parameters indicated in Section 2 of the QAPP.

3.3 LIGHT, NON-AQUEOUS PHASE LIQUID (LNAPL) SAMPLING PROCEDURES

When necessary, light, non-aqueous phase liquid (LNAPL) samples will be collected from selected existing monitoring wells and newly installed monitoring wells in which LNAPL is determined to be present in sufficient quantity to fill the required sample bottle. LNAPL samples will be analyzed for gas chromatographic (GC) fingerprint and specific gravity.

An oil/water interface probe will be lowered slowly into the well to determine if LNAPL is present. The thickness of the LNAPL layer (if present) will be measured using the oil/water interface probe and recorded in the field log book. Subsequently, a sample of the LNAPL (if present) will be collected using a disposable, bottom-fill bailer. Care will be taken to lower the bailer just through the floating layer but not significantly down into the underlying groundwater.

3.4 WASTE CLASSIFICATION SAMPLING PROCEDURES

Waste classification samples from the disposal and PCB areas will be collected from the stockpiles in accordance with sampling procedures identified in NJDEP's *Field Sampling Procedure Manual* (May 1992).

Waste classification samples for the inorganic hotspot soils will be collected from the backhoe bucket using a decontaminated sampling device and transferred into laboratory cleaned jars. Samples will be homogenized in a stainless steel bowl and subsequently placed into the sample bottle.

All areas are anticipated to be less than 900 cubic yards in volume, hence one waste classification sample will be collected for every 20 cubic yards of volume. The waste and soil stockpiles will be divided into grids representing no more than 20 cubic yards of waste. One waste classification sample will then be collected from each grid.

3.5 FIELD SCREENING PROCEDURES

3.5.1 Field Portable X-Ray Fluorescence (XRF)

The Spectrace 9000 Field Portable XRF will be utilized at the L.E. Carpenter site as a field screening instrument for lead and antimony. Attachment A includes procedures for the proper use of the XRF as provided in the U.S. EPA Standard Operating Procedure for the Spectrace 9000 XRF and in the instruments operating instructions. The Spectrace 9000 XRF is equipped with a remote probe, yet has a resolution sufficient to provide QA II quality data.

3.5.2 EnSys Immunoassay Field Testing Kit

The EnSys Immunoassay Field Testing Kit will be utilized at the L.E. Carpenter site to screen for PCBs, specifically Arochlor 1254. The field test procedure will be performed according to the kits' standard procedure (included as Attachment B). The designated field test kit, an EnSys PCB RIS Soil Test System, conforms to proposed EPA method 4020 for immunoassay-based field screening for PCBs in soil. It has a minimum detection level of 0.4 mg/kg for Arochlor 1254, which is adequate for this site.

Screening will be used to direct the depth of excavation activities to ensure all contamination is removed and to minimize the volume of excavated materials. Screening will not be used to determine the areal extent of excavation, as the PCB delineation sampling (December 1993) previously determined the required excavation extent. Samples testing greater than 2 mg/kg will indicate further excavation is required.

SECTION 4.0

FIELD ACTIVITIES

4.1 DECONTAMINATION PROCEDURES

All sampling instruments for soil (stainless steel scoops, bowls, augers), and groundwater (teflon bailers) will be decontaminated prior to use as per the NJDEP "Field Sampling Procedures Manual" (May 1992), and dedicated to a particular location for that day. All "down-hole" drilling equipment used for well installation/abandonment will be steam cleaned prior to use and between sample locations. Water level, specific conductivity, pH, dissolved oxygen and temperature probes will be wiped clean and rinsed with deionized water between and prior to use.

4.2 PUMPING TEST PROCEDURES

Aquifer pumping tests are required for the identification of aquifer parameters and the design of an effective pump and treat system. Constant rate pumping tests will be performed in the shallow(a) aquifer zone and the shallow/intermediate aquifer zone at the site. In order to ensure that these aquifer tests will yield reliable and useful data, several preliminary steps will be undertaken. These preliminary steps include: (1) development of background water level trends; (2) performance of a short duration step-drawdown tests; and (3) field evaluation of data to determine that the test is of sufficient duration. During the constant rate pumping tests, it is essential to follow the prescribed pumping test methodology.

4.2.1 Development of Background Water Level Trends

Prior to the performance of the constant rate pumping test, background water level trends will be established so that flow conditions in the static (non-stressed) aquifer can be determined. Water level monitoring will be conducted in some of the piezometers and monitoring wells on site. Monitoring for the identification of background water level trends will last for at least two days prior to the initiation of the test.

4.2.2 Step Drawdown Test

In an attempt to determine the optimal pumping rate for each of the constant rate pumping tests, a step drawdown test will be performed. Water generated during this test can either be pumped to a distant area which will not affect water level readings in the pumping well or stored in a tanker with a capacity less than 10,000 gallons. If the water is stored, upon completion of the test, this water will be discharged into the groundwater plume.

During the test, water levels will be measured in the well as it is pumped at successively higher rates. At least three steps of increasing pump discharge rates will be run. Pump rates will be approximately 50 percent, 100 percent, and 125 percent of what the well is capable of sustaining. These rates are tentative; actual pump rates will be determined in the field.

4.2.3 Aquifer Pumping Test Methodologies

During the aquifer pumping tests, the well will be pumped at a constant rate. At locations where LNAPL is not present, pressure transducers or Stevens® Continuous Water Level Recorders will be utilized to monitor water level fluctuations.

At locations when LNAPL is present, accurate measurements will be collected using a calibrated oil/water interface probe. The oil/water probe will provide specific measurements of the thickness of the product column and the thickness of the water column within the well. During the test, discharged water will be pumped through an oil/water separator and into storage tank(s). In addition to monitoring water levels, barometric pressure, and if required, precipitation measurements will be collected.

All data acquired during the test will be reduced and analyzed by the applicable methods.

A groundwater sample will be collected at the beginning of the pumping test. An additional groundwater sample will be collected near the end of the test. The samples will be analyzed for the suite of parameters specified in Section 2.3. The groundwater analytical results will be used during design of the groundwater treatment system, to determine approximate system influent concentrations.

4.2.4 Recovery Test

Upon completion of the test, the pump will be turned off. Water level will be monitored in monitoring points where drawdown was noted. At locations where pressure transducers are being utilized, the data logger will be stepped and the log mode of data collection will be reinitiated. Measurements will continue until 90 percent recovery (i.e., groundwater level within well is within 90 percent of level prior to pumping) is obtained in the pumping well.

4.2.5 Well Redevelopment

Well RW-2 will be redeveloped in an attempt to make the well as efficient as possible. Development will be performed by pumping and surging. During the development process, specific capacity tests will be conducted intermittently to identify the drawdown associated with a specific pump rate. Development will continue until specific capacity rates have approximately stabilized.

4.3 PERCOLATION TEST PROCEDURES

Percolation tests will also be performed at the site to help identify the rate at which treated/extracted water can be infiltrated into the vadose zone. The percolation tests will be conducted at several locations across the site for the determination of the design permeability. Percolation tests will be performed as outlined in 7:9A-6.4 of the New Jersey Register.

4.4 INFILTRATION TEST PROCEDURES

Infiltration tests will be performed at the site to help identify the maximum rate at which treated/extracted water can be infiltrated into the vadose zone. A pilot scale infiltration gallery will be installed at the site in accordance with the full scale infiltration system specifications. The infiltration gallery will consist of horizontal sections of perforated polyethylene pipe and within a geotextile-lined, gravel-filled excavation. The pilot scale system will be connected to the full scale system upon its construction.

4.5 INJECTION TEST PROCEDURES

Injection tests will be performed in the shallow (a) aquifer zone using CW-2, and the shallow/intermediate aquifer zones using RW-3 to identify the ability of the aquifer to accept water. The tests will identify the potential success of injecting treated water through the injection wells. The tests will be performed by injecting potable water into RW-3 and accumulated aquifer test water into CW-2. The water shall be injected at successively increasing rates, and it is anticipated that three steps will be required. Flow rates will be determined in the field. Water levels will be monitored with a pressure transducer. Each step will run approximately four hours.

4.6 GROUNDWATER MODELING PROCEDURES

A tentative recovery well/injection well configuration will be identified by modeling an enhanced conceptual site model using a numerical, 3-dimensional, block-centered finite difference code. It is anticipated that MODFLOW, utilizing its pre- and post-processors, will be utilized. Results of the modeling effort will aid in locating additional recovery/injection points required to capture the plume and reinject water into the subsurface.

4.7 MONITORING WELL INSTALLATION PROCEDURES

Additional monitoring points are required to evaluate specific hydrogeologic zones at the site. Installation will be performed in accordance with NJDEP's *Field Sampling Procedures Manual*. The well installation will be performed by a New Jersey licensed well driller using mud or air rotary drilling techniques. Polyvinyl chloride (PVC) casing will be used in the single and double cased well installation. As part of this process, NJDEP well permits, Form A (As Built Specifications), and Form B (Surveyor Documentation) are required. After the well is

constructed, it will be developed. Conditions in the well will be given at least two weeks to allow for stabilization.

4.8 MONITORING WELL ABANDONMENT PROCEDURES

Several of the monitoring wells and piezometers must be abandoned because they are located in areas requiring excavation for soil remediation. Additionally, several wells are poorly constructed and require abandonment. Abandonment procedures will be performed in accordance with N.J.A.C. 7:9-9. The abandonments will be performed by a New Jersey licensed well driller.

4.9 EXCAVATION PROCEDURES

Inorganic hotspots, DEHP/organic hotspots, disposal area and PCB contaminated soils will be remediated by excavation of contaminated materials using a backhoe. Areas to be excavated have been estimated based on analytical data obtained during the RI and PCB delineation sampling. Excavated materials from inorganic hotspots, disposal area and PCB contaminated soils will be disposed off-site. Excavated soils from the DEHP/organic hotspots will be backfilled in the disposal area open excavation.

Following excavation and post-excavation sampling of the inorganic hotspots, organic/DEHP hotspots and PCB contaminated soils, the open excavations will be backfilled with clean fill. Post-excavation samples will be collected from the inorganic hotspots, organic/DEHP hotspots and PCB contaminated soils with the frequency described in subsection 2.2 of the QAPP.

Following excavation of the disposal area, the excavated soils from the DEHP/Organic Hotspots will be backfilled in the disposal area open excavation and remediated in-situ. Post-excavation samples will be collected only for the parameters of antimony and lead, at the frequency specified in Section 2.2 of the QAPP.

Field screening methods (X-Ray Fluorescence (XRF)) will be used to screen for antimony and lead during inorganic hotspot remediation. The XRF results will be used to direct the excavation activities to ensure all contamination is removed and to minimize the volume of excavated materials. In addition, field screening methods (PCB test kits) will be used to screen for Arochlor 1254 during PCB contaminated soil remediation. The PCB test kit results will be used to direct the depth of excavation activities to ensure all contamination is removed and to minimize the volume of excavated materials. The maximum depth of excavation (for PCB) will be two feet, as specified in the ROD. If elevated levels of DEHP remain at depths below two feet, the maximum depth of excavation for DEHP will be at the depth of the water table.

SECTION 5.0

FIELD ANALYTICAL INSTRUMENTATION

Preventive maintenance and calibration by manufacturers' service representatives are provided on a routine basis. The maintenance procedures and frequencies for major instruments are provided in the following subsections.

5.1 CALIBRATION PROCEDURES

This subsection reviews calibration methods and frequencies for field equipment to be used during remedial activities at the L.E. Carpenter facility. Calibration activities and results will be recorded in the field logbook.

5.1.1 Specific Conductance Meter

The YSI Model 33, or equivalent, is a portable battery-operated transistorized instrument used to measure salinity, specific conductance, and temperature in surface water, groundwater, and wastewater systems. The meter is calibrated daily or each time the meter is turned on (if more than once per day) by turning the MODE control to REDLINE and adjusting the REDLINE control so that the indicator lines up with the redline on the meter face. A manufacturer recommended calibration solution commercially prepared from water and KCl will be used to ensure standardized instrument response. At a minimum the KCl standard solution will be used for calibration after every 15 samples. Calibration activities and results will be recorded in the field logbook.

5.1.2 pH Meter

The Fisher Model No. 107 pH Meter, or equivalent, is a portable pH monitoring instrument for determining pH in surface and groundwaters, wastewater systems, and other water quality applications.

The instrument requires field calibration daily or each time the meter is turned on (if more than once per day). Distilled water and buffer solutions (pH 7 and pH 4) are required for field calibration. These solutions will be obtained from the WESTON laboratory. All solutions must be at the same temperature to reduce meter stabilization time and to maintain accuracy. The instrument will be calibrated prior to each sampling event. Calibration activities and results will be recorded in the field logbook.

5.1.3 Dissolved Oxygen Meter

The YSI Model 50B Dissolved Oxygen Meter, or equivalent, will be used to measure dissolved oxygen levels in groundwater. The meter is calibrated daily or each time the meter is turned on (if more than once per day). A manufacturer recommended calibration solution commercially prepared from water and KCl will be used to ensure standardized instrument response. At a minimum the KCl standard solution will be used for calibration after every 15 samples. Calibration activities and results will be recorded in the field logbook.

5.1.4 HNu Photoionization Detector

The HNu photoionization detector (or equivalent) is designed to measure the concentration of trace gases in many industrial/plant atmospheres and environmental applications. The analyzer employs the principle of photoionization for detection. A sensor, consisting of a sealed ultraviolet light source, emits photons which are energetic enough to ionize many trace species, particularly organics. The HNu instrument will be calibrated, following the manufacturer's suggested procedure, at a frequency of once per day at minimum. Calibration standard gases provided by the manufacturer or authorized vendor will be utilized.

5.1.5 Organic Vapor Meter

The Thermo Environmental Systems Organic Vapor Meter (OVM) is designed to determine the relative concentration of air contaminants. The detection method utilized is photoionization. The sample is drawn into the ionization chamber through the jet electrode where UV radiation from the lamp ionizes the sample if the photons' energy is sufficient. The instrument will not detect methane. The OVM is factory tested for calibration and linearity, using isobutylene. The instrument will be calibrated before each use, as specified by the manufacturer, following their calibration routine. The calibration gasses specified by the manufacturer will be used. Calibration activities and results will be recorded in the field logbook.

5.1.6 Organic Vapor Analyzer (OVA)

The Century portable organic vapor analyzer (OVA), or equivalent is designed to detect and measure gases and organic vapors in the atmosphere. The instrument utilizes the principle of hydrogen flame ionization for detection. The organic vapor analyzer measures gasses and vapors by producing a response to an unknown sample which can be related to a gas of known composition to which the instrument has been previously calibrated. The instrument is normally calibrated to methane gas. The OVA instrument will be calibrated, following the manufacturer's suggested procedure, at a frequency of once per day at minimum. Calibration standard gases provided by the manufacturer or authorized vendor will be utilized.

5.1.7 Field Portable X-Ray Fluorescence (XRF)

Generally, calibration standards are not necessary for site screening and extent of contamination analyses with the Spectrace 9000 Field Portable XRF or equivalent. Site-specific calibration can be done by analyzing a set of site-specific calibration standards and performing a regression analysis on the reference sample results and the XRF results; however it is anticipated that this calibration method will not be used at the L.E. Carpenter site.

An energy calibration should be performed after an instrument is shipped and periodically thereafter (approximately 2 weeks) to ensure proper energy calibration. The energy calibration procedure is described in the attached U.S.EPA Standard Operating Procedure for the Spectrace 9000 Field Portable X-Ray Fluorescence Meter (Attachment A).

5.1.8 ENSYS Immunoassay Field Testing Kit

The manufacturer will supply the field test with the test level adjusted to the action level, 2 mg/kg, for this site. Because this test is specific for Arochlor 1254, no interferences are expected.

5.2 PREVENTATIVE MAINTENANCE PROCEDURES

As discussed in Section 5.1, the field equipment will be properly calibrated, charged, and in good general working condition prior to the beginning of each working day.

Field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during cold weather working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a cool dry room for overnight storage.

Subcontractor equipment (e.g., drill rigs, water trucks, etc.) will arrive at the site each day in proper working condition. Lubrication, hydraulic, and motor oil will generally be checked by the subcontractors prior to the start of the work day to make certain all fluid reservoirs are full and there are no leaks. Prior to the start of work each day, the WESTON Field Supervisor will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

The EnSys RIS Immunoassay Field Test Kits will be used for field screening for Arochlor 1254 at the site. As with any analytical method, using improper techniques can negatively affect the analysis. Procedures to be avoided include: improper washing techniques, not seating the pipette tips properly, air bubbles in the micropipette, improper placement of tubes into the photometer, potential photometer malfunction, and improper storage and handling of the kits.



The Spectrace 900 Field Portable XRF will be used for field screening for lead and antimony at the site. Generally, the instrument precision is the least significant source of error in XRF analysis. User- or application-related error is generally more significant and will vary with each site and method used. Potential user related errors can include sample placement and representativeness and using a non-representative reference sample. Application related errors can result from chemical matrix effects due to sample chemical composition, physical matrix effects due to sample morphology, application error, non-representative moisture content, and severe X-ray spectrum overlaps. Samples must be free of rocks/debris and sample particle size must be evenly distributed to ensure accurate analysis. Proper care and preventive maintenance will be taken to avoid any potential problems with the analytical techniques.

ATTACHMENT A

**U.S. EPA STANDARD OPERATING PROCEDURE
FOR THE SPECTRACE 9000 XRF**

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 1 of 33
REV: 1.0
DATE: 12/21/92

TABLE OF CONTENTS

1.0	SCOPE AND APPLICATION
1.1	Principles of Operation
1.1.1	Characteristic X-rays
1.1.2	Scattered X-rays
1.2	Sample Types
2.0	METHOD SUMMARY
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
4.0	INTERFERENCES AND POTENTIAL PROBLEMS
4.1	Sample Placement
4.2	Sample Representivity
4.3	Reference Analysis
4.4	Chemical Matrix Effects (Due to the Chemical Composition of the Sample)
4.5	Physical Matrix Effects (Due to Sample Morphology)
4.6	Application Error
4.7	Moisture Content
4.8	Cases of Severe X-ray Spectrum Overlaps
5.0	EQUIPMENT / APPARATUS
5.1	Description of the Spectrace 9000 System
5.2	Equipment and Apparatus List
5.2.1	Spectrace 9000 Analyzer System
5.2.2	Optional Items
5.2.3	Limits and Precautions
5.3	Peripheral Devices
5.3.1	Communication Cable Connection
5.3.2	Communication Port Setup
5.3.3	User Software

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713

PAGE: 2 of 33

REV: 1.0

DATE: 12/21/92

TABLE OF CONTENTS (cont'd)

5.4 Instrument Maintenance

5.4.1 Probe Window

5.4.2 Further Information and Troubleshooting

6.0 REAGENTS

6.1 Site Specific Calibration Standards (SSCS)

6.1.1 SSCS Sampling

6.1.2 SSCS Preparation

7.0 PROCEDURE

7.1 Prerequisites

7.1.1 Gain Control

7.1.2 Setting Data and Spectrum Store/Send Mode

7.2 General Keys and Menu Software

7.2.1 The Keyboard

7.2.2 The Measure (Ready) Screen

7.2.3 The Choose an Application Screen

7.2.4 The Review Stored Results Screen

7.2.5 The Review Stored Spectra Screen

7.2.6 The More (Other Functions) Screen

7.2.7 The Results Screen

7.3 Preoperational Checks

7.3.1 Energy Calibration and Energy Calibration Check

7.3.2 Resolution Check

7.3.3 Blank (Zero) Sample Check

7.3.4 Target Element Response Check

7.4 Selecting Source Measuring Time

7.4.1 Minimum Source Measuring Times

7.4.2 Typical Minimum Detection Limits (MDLs) for the Soil Samples Application

7.4.3 Typical Minimum Detection Limits (MDLs) for the Thin Samples Application

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 3 of 33
REV: 1.0
DATE: 12/21/92

TABLE OF CONTENTS (cont'd)

7.5	Sample Handling and Presentation
7.5.1	Soil Samples
7.5.2	Thin (Filter) Samples
7.5.3	Lead in Paint
8.0	CALCULATIONS
9.0	QUALITY ASSURANCE / QUALITY CONTROL
9.1	Precision
9.1.1	Preliminary Minimum Detection Limit (PMDL) and Minimum Quantitation Limit (PMQL)
9.1.2	The Method Minimum Detection Limit (MMDL) and Method Quantitation Limit (MQL)
9.2	Reporting Results
9.3	Accuracy
9.3.1	Matrix Considerations
10.0	DATA VALIDATION
10.1	Confirmation Samples
10.2	Recording Results
10.3	Downloading Stored Results and Spectra
11.0	HEALTH AND SAFETY
12.0	REFERENCES
13.0	BIBLIOGRAPHY
14.0	APPENDIX
A.	Figures

COMPLETE REWRITE, REVISION 1.0, DECEMBER, 1992

SUPERCEDES: SOP #1713, REVISION 0, 8/31/92

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 4 of 33
REV: 1.0
DATE: 12/21/92

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to serve as a guide to the start-up, check out, operation, calibration, and routine use of the Spectrace 9000 field portable x-ray fluorescence instrument for field use in screening hazardous or potentially hazardous inorganic materials. It is not intended to replace or diminish the use of the Spectrace 9000 Operating Instructions. The Operating Instructions contain additional information for optimizing instrument performance and for utilizing different applications.

The procedures contained herein are general operating guidelines which may be changed as required, depending on site conditions, equipment limitations, limitations imposed by Quality Assurance/Quality Control (QA/QC) procedure or other protocol limitations. In all instances, the procedures finally employed should be documented and included in any or all final reports. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

1.1 Principles of Operation

X-ray Fluorescence (XRF) spectroscopy is a non destructive qualitative and quantitative analytical technique used to determine the chemical composition of samples. In a source excited XRF analysis, primary X-rays emitted from a sealed radioisotope source are utilized to irradiate samples. During interaction with samples, source X-rays may either undergo scattering (dominating process) or absorption by sample atoms in a process known as the photoelectric effect (absorption coefficient). This phenomenon originates when incident radiation knocks out an electron from the innermost shell of an atom creating a vacancy. The atom is excited and releases its surplus energy almost instantly by filling the vacancy with an electron from one of the higher energy shells. This rearrangement of electrons is associated with the emission of X-rays characteristic (in terms of energy) of the given atom. This process is referred to as emission of fluorescent X-rays (fluorescent yield). The overall efficiency of the fluorescence process is referred to as excitation efficiency and is proportional to the product of the absorption coefficient and the fluorescent yield.

1.1.1 Characteristic X-rays

The Spectrace 9000 utilizes characteristic X-ray lines originating from the innermost shells of the atoms: K, L, and occasionally M. The characteristic X-ray lines of the K series are the most energetic lines for any element and, therefore, are the preferred analytical lines. The K lines are always accompanied by the L and M lines of the same element. However, with energies much lower than those of the K lines, they can usually be neglected for those elements for which the K lines are analytically useful. For heavy elements such as cerium (Ce) (atomic number [Z]=58), to uranium (U, Z=92), the L lines are the preferred lines for analysis. The L_{α} and L_{β} lines have almost equal intensities, and the choice of one or the other depends on what interfering lines might be present. A source just energetic enough to excite the L lines will not excite the K lines of the same element. The M lines will appear together with the L lines.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 5 of 33
REV: 1.0
DATE: 12/21/92

The Spectrace 9000 Operating Instructions contain a table that identifies the X-rays (K or L) and elements measured for each excitation source.

An X-ray source can excite characteristic X-rays from an element only if the source energy is greater than the absorption edge energy for the particular line group of the element (e.g., K absorption edge, L absorption edge, M absorption edge). The absorption edge energy is somewhat greater than the corresponding line energy. Actually, the K absorption edge energy is approximately the sum of the K, L, and M line energies, and the L absorption edge energy is approximately the sum of the L and M line energies of the particular element.

Energies of the characteristic fluorescent X-rays are converted (within the detector) into a train of electric pulses, the amplitudes of which are linearly proportional to the energy. An electronic multichannel analyzer (electronic unit) measures the pulse amplitudes, which is the basis of a qualitative X-ray analysis. The number of counts at a given energy is representative of element concentration in a sample and is the basis for quantitative analysis.

1.1.2 Scattered X-rays

The source radiation is scattered from the sample by two physical processes: coherent or elastic scattering (no energy loss), and Compton or inelastic scattering (small energy loss). Thus, source backscatter (background signal) actually consists of two components with X-ray lines close together. The higher energy line is equal to the source energy. Since the whole sample takes part in scattering, the scattered X-rays usually yield the most intense lines in the spectrum. Furthermore, the scattered X-rays have the highest energies in the spectrum and, therefore, contribute most of the total measured intensity signal.

1.2 Sample Types

Solid and liquid samples can be analyzed for elements aluminum (Al) through uranium (U) with proper X-ray source selection and instrument calibration. Typical environmental applications are:

- Heavy metals in soil (in-situ or samples collected from the surface or from bore hole drillings, etc.), sludges, and liquids (e.g., lead (Pb) in gasoline)
- Light elements in liquids (e.g., phosphorus [P], sulphur [S], and chlorine [Cl] in organic solutions)
- Heavy metals in industrial waste stream effluents

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 6 of 33
REV: 1.0
DATE: 12/21/92

- PCB in transformer oil by Cl analysis
- Heavy metal air particulates collected on membrane filters, either from personnel samplers or from high volume samplers.
- Lead (Pb) in paint

2.0 METHOD SUMMARY

The Spectrace 9000 Portable XRF Analyzer employs three radioactive isotope sources: iron-55 (Fe-55), cadmium-109 (Cd-109), and americium-241 (Am-241) for the production of primary X-rays. Each source emits a specific set of primary X-rays which excite a corresponding range of elements in a sample. When more than one source can excite the element of interest, the appropriate source is selected according to its excitation efficiency for the element of interest. See page 1-2 of the Spectrace 9000 Operating Instructions for a chart of source type versus element range.

The sample is positioned in front of the source-detector window and sample measurement is initiated which exposes the sample to primary radiation from the source. Fluorescent and backscattered X-rays from the sample enter through the beryllium (Be) detector window and are counted in the high resolution mercuric iodide (HgI₂) detector.

Elemental concentrations are computed using a Fundamental Parameter (FP) algorithm of the form:

$$\text{Concentration} = R \times S \times (1 + \text{SUM}\{A_n \times C_n\})$$

"R" is the measured analyte X-ray intensity relative to the pure element; "S" is a calculated sensitivity coefficient. The quantity SUM{} is a summation of "n"-element absorption-enhancement terms containing calculated alpha-coefficients and iteratively computed element concentrations. The Spectrace 9000 utilizes FP XRF calibrations derived from theoretical considerations (as opposed to empirical data). The menu-driven software in the Spectrace 9000 supports multiple XRF calibrations called "applications." Each application is a complete analysis configuration including elements to be measured, interfering elements in the sample, and a set of FP calibration coefficients.

The measurement time of each source is user-selectable. The shorter source measurement times (15 - 30s) are generally used for initial screening and hot spot delineation, while longer measurement times (30 - 500s) are typically used for higher precision and accuracy requirements.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This SOP specifically describes equipment operating procedures for the Spectrace 9000; hence, this section is not applicable to this SOP.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 7 of 33
REV: 1.0
DATE: 12/21/92

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The total method error for XRF analysis is defined as the square root of the sum of squares of both instrument precision and user or application related error. Generally, the instrument precision is the least significant source of error in XRF analysis. User- or application-related error is generally more significant and will vary with each site and method used. The components of the user or application related error are the following.

4.1 Sample Placement

This is a potential source of error because the X-ray signal decreases as the distance from the radioactive source is increased. However, this error is minimized by maintaining the same distance for each sample.

4.2 Sample Representivity

In order to accurately characterize site conditions, samples collected must be representative of the site or area under investigation. Representative soil sampling ensures that a sample or group of samples accurately reflects the concentration of the contaminant(s) of concern at a given time and location. Analytical results from representative samples reflect the variation in pollutant presence and concentration range throughout a site. Variables affecting sample representativeness include: (1) geologic variability, (2) contaminant concentration variability, (3) collection and preparation variability, and (4) analytical variability. Attempts should be made to minimize these sources of variability. For additional information on representative sampling, refer to the "Removal Program Representative Sampling Guidance, Volume 1 - Soil."⁽¹⁾

4.3 Reference Analysis

Soil chemical and physical matrix effects may be corrected by using site-specific soil samples which have been analyzed by Inductively-Coupled Plasma (ICP) or Atomic Absorption (AA) spectroscopy as calibration samples. A major source of error can result if these samples are not representative of the site and/or if the analytical error is large. Additionally, when comparing XRF results with reference analyses results, the efficiency of the sample digestion reference analysis should be considered. Some digestion methods may breakdown different sample matrices more efficiently than others.

4.4 Chemical Matrix Effects (Due to the Chemical Composition of the Sample)

Chemical matrix effects result from differences in concentrations of interfering elements. These effects appear as either spectral interferences (peak overlaps) or as X-ray absorption/enhancement phenomena. Both effects are common in soils contaminated with heavy metals. For example, iron (Fe) tends to absorb copper (Cu) X-rays, reducing the intensity of Cu measured by the detector. This effect can be corrected mathematically through the use of FP coefficients.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 8 of 33
REV: 1.0
DATE: 12/21/92

4.5 Physical Matrix Effects (Due to Sample Morphology)

Physical matrix effects are the result of variations in the physical character of the sample. They may include such parameters as particle size, uniformity, homogeneity, and surface condition. For example, consider a sample in which the analyte exists in the form of very fine particles within a matrix composed of much coarser material. If two separate aliquots of the sample are prepared in such a way that the matrix particles in one are much larger than in the other, then the relative volume of analyte occupied by the analyte-containing particles will be different in each. When measured, a larger amount of the analyte will be exposed to the source X-rays in the sample containing finer matrix particles; this results in a higher intensity reading for that sample and, consequently, an apparently higher measured concentration for that element.

4.6 Application Error

Generally, the error in the application calibration model is insignificant (relative to the other sources of error) PROVIDED the instrument's operating instructions are followed correctly. However, if the sample matrix varies significantly from the design of the application, the error may become significant (e.g., using the soils application to analyze a 50 percent iron mine tailing sample).

4.7 Moisture Content

Sample moisture content will affect the analytical accuracy of soils or sludges. The overall error may be secondary when the moisture range is small (5-20 percent), or it may be a major source of error when measuring the surface of soils that are saturated with water.

4.8 Cases of Severe X-ray Spectrum Overlaps

When present in the sample, certain X-ray lines from different elements can be very close in energy and, therefore, can interfere by producing a severely overlapped spectrum.

The typical spectral overlaps are caused by the K_{α} line of element Z-1 (or as with heavier elements, Z-2 or Z-3) overlapping with the K_{α} line of element Z. This is the so-called K_{α}/K_{α} interference. Since the $K_{\alpha}:K_{\beta}$ intensity ratio for the given element usually varies from 5:1 to 7:1, the interfering element, Z-1, must be present in large concentrations in order to disturb the measurement of analyte Z. The presence of large concentrations of vanadium (V) could disturb the measurement of chromium (Cr). The V K_{α} and K_{β} energies are 4.951 and 5.427 Kev, respectively. The Cr K_{α} energy is 5.41 Kev. The resolution of the detector is approximately 270 eV. Therefore, large amounts of V in a sample will result in spectral overlap of the V K_{β} with the Cr K_{α} peak (see Figure 1, Appendix A) and the measured X-ray spectrum will include TOTAL counts for Cr plus V lines.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713

PAGE: 9 of 33

REV: 1.0

DATE: 12/21/92

Other interferences arise from K/L, K/M, and L/M line overlaps. While these are less common, the following are examples of severe overlap:

As K_{α} /Pb L_{α} , S K_{α} /Pb M_{α}

In the arsenic (As)/lead case, Pb can be measured from the Pb L_{α} line, and arsenic from either the As K_{α} or the As K_{β} line; this way the unwanted interference can be corrected. However, due to the limits of mathematical corrections, measurement sensitivity is reduced. Generally, arsenic concentrations can not be efficiently calculated in samples with Pb:As ratios of 10:1 or more. This may result in zero arsenic being reported regardless of what the actual concentration is.

The Spectrace 9000 uses overlap factors to correct for X-ray spectral overlaps for the elements of interest for a given application.

5.0 EQUIPMENT / APPARATUS

5.1 Description of the Spectrace 9000 System

The analyzer utilizes the method of Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometry to determine the elemental composition of soils, sludges, aqueous solutions, oils, and other waste materials.

The Spectrace 9000 analyzer includes three compact, sealed radiation sources contained in a measuring probe: Fe-55, Cd-109, and Am-241. The analyzer software automatically selects which sources to use as well as measurement time for each source based on stored information for each application. The probe is equipped with a high resolution HgI₂ detector, which is connected by cable to an environmentally sealed electronic module.

The electronic unit provides internal non volatile memory for storage of 120 spectra and 300 multi-element analysis reports. An RS-232 serial port is provided for downloading data and spectra to a peripheral device. The multi-element analysis reports and the 2000-channel spectra can be displayed on the instrument's LCD panel. The replaceable and rechargeable internal battery provides for field-portable operation.

The Spectrace 9000 is supplied with three factory-installed FP-based applications (calibrations). The "Soil Samples" application is for analysis of soils where the balance of the sample (that portion not directly measured by the instrument) is silica (SiO₂). The "Thin Film" application is for analysis of thin films such as air monitoring filters or wipes. Finally, the "PbK in Paint" application is for analyzing Pb in paint films and is reasonably independent of the type of substrate. Spectrace Instruments will also develop calibrations to meet new user application requirements (e.g., adding elements to the present "Soil Samples" application).

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 10 of 33
REV: 1.0
DATE: 12/21/92

The Spectrace 9000 can be powered from a 115-volt (or 220-volt) wall outlet or from its 4-hour capacity battery. It can be operated in temperatures ranging from 32 to 120° Fahrenheit (F). Furthermore, the probe and electronic unit may be exposed to a light rain. However, additional protection is provided when the system (electronic unit and probe) is contained in the optional water repellant carrying case.

5.2 Equipment and Apparatus List

5.2.1 Spectrace 9000 Analyzer System

The complete Spectrace 9000 Analyzer System includes:

- Analyzer unit for data acquisition, processing, and display
- Hand-held probe including:
 - High-resolution HgI₂ detector
 - Three excitation sources (⁵⁵Fe, ¹⁰⁹Cd, ²⁴¹Am)
 - Safety cover
- Probe laboratory stand with the following:
 - Base for table top use
 - Safety shield over sample
 - Positioning fixtures for standard 30-mm and 40-mm X-ray sample cups
- Interconnecting cable
- RS-232C Serial I/O Interface cable
- Two blank check samples
- Pure element check samples
- Battery charger
- Battery pack
- System carrying/shipping case
- Spectrace 9000 Operating Instructions, application software, and utilities software. The application software is specific to each unit and cannot be interchanged between different units. The software is identified by the serial number of the unit.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713

PAGE: 11 of 33

REV: 1.0

DATE: 12/21/92

5.2.2 Optional Items

- 31-mm diameter sample cups
- XRF polypropylene film, 0.2 mil thick
- Field carrying case
- Peripheral devices such as a printer and IBM compatible Personal Computer (PC)
- Spare probe window assembly
- Spare battery pack, charger, and charger adaptor (required to charge spare battery outside of electronic unit)

See the Spectrace 9000 Accessories Price List for additional options.

For mobile lab or laboratory X-ray sample preparation accessories (such as drying ovens, grinders, sieves, etc.), consult general laboratory equipment suppliers.

5.2.3 Limits and Precautions

The probes should be handled in accordance with the following radiological control practices.

1. The probe should always be in contact with the surface of the material being analyzed, and that material should completely cover the probe opening (aperture) when the sources are exposed. Do not remove a sample or move the probe while the indicators show **SOURCE ON**.

SOURCE ON indicators are:

- the message on the screen "**SOURCE ON**"
 - the flashing light at the base of the probe.
2. When the sources are exposed, under no circumstances should the probe be pointed at the operator or surrounding personnel.
 3. Do not place any part of the operator's or co-worker's bodies in line of exposure when the sources are exposed or partially covered.
 4. The probe must be covered with the safety cover or laboratory safety shield when not in use.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 12 of 33
REV: 1.0
DATE: 12/21/92

5. Spectrace Instruments must be notified immediately of any condition or concern relative to the probe's structural integrity, source shielding, source switching condition, or operability.
6. The appropriate state agency or the Nuclear Regulatory Commission (NRC) office must be notified immediately of any damage to the radioactive source, or any loss or theft of the device (see factory supplied data on radiological safety).
7. Labels or instructions on the probe(s) must not be altered or removed.
8. The user must not attempt to open the probe.
9. The source(s) in the probe must be leak-tested every 6 months as described in the Spectrace 9000 Operating Instructions. The leak test certificates must be kept on file, and a copy must accompany the instrument at all times.
10. The probe laboratory safety shield assembly must be used when the probe is inverted for measuring samples contained in cups.
11. During operation, the probe must be kept at least 10 feet from computer monitors and any other source of radio frequency (RF). Some monitors have very poor RF shielding and will affect measurement results.
12. The Spectrace 9000 should not be dropped or exposed to conditions of excessive shock or vibration.
13. The electronic unit should be left on whenever the battery charger is connected to it. If the electronic unit is shut off with the battery charger plugged in, the battery may be damaged due to overcharging.

Additional precautions include:

1. The probe cable must never be pulled while unplugging the probe. The probe plug should be grasped at the ribbed metal connector and squeezed and pulled gently while the connector is unplugged. The connector must never be forced when plugging in the connector.
2. The handle of the electronic unit must not be rotated unless the release buttons on each side of the handle are depressed.
3. The Spectrace 9000 should not be stored at an ambient temperature below -4°F or above 110°F.
4. The battery charging unit should only be used indoors in dry conditions.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 13 of 33
REV: 1.0
DATE: 12/21/92

5. Battery packs should be changed only in dry conditions.

5.3 Peripheral Devices

The Spectrace 9000 may be used with a wide range of peripheral devices for electronic data capture or printed readout as long as they are compatible with the RS-232 serial I/O protocol. Such devices include terminals, printers, electronic data loggers, personal computers, etc.

5.3.1 Communication Cable Connection

Plug the 25-pin connector of the RS-232 Serial I/O cable into the Spectrace 9000 25-pin connector (the connection just below the display screen on the electronic unit) and the 9-pin connector of the cable into the serial port of the receiving device.

5.3.2 Communication Port Setup

To communicate with an external device, the Spectrace 9000 **MUST** be set at the same baud rate, word length, and parity as the receiving device. The Spectrace 9000 allows you to select various configurations for these parameters in the communication (Comm.) port setup portion of the More submenu (which can be accessed from the main menu). The default COM setup for application and utilities software is 9600,N,8,1.

5.3.3 User Software

Refer to your PC software manual for details on additional settings that may be required for proper interfacing between the Spectrace 9000 and your particular software.

5.4 Instrument Maintenance

5.4.1 Probe Window

Should the probe window become damaged or punctured, it should be replaced as soon as possible to prevent dust and moisture from entering the probe. Replacement window assemblies can be ordered from Spectrace Instruments. Note the location of the window aperture; it is closer to one end of the window plate. Simply unscrew the old window plate, press any corner of it, and remove it. Stretch the O-ring for 10 seconds, and lay it back in the groove. The O-ring must lie flat in the groove in order for the new window plate to be installed. Install the new window assembly in the same manner as the old. If the surface of the window plate is not flush with the face of the probe, the O-ring has probably come out of the groove. Remove the assembly, and try the same procedure again.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 14 of 33
REV: 1.0
DATE: 12/21/92

5.4.2 Further Information and Troubleshooting

Refer to the Spectrace 9000 Operating Instructions for additional detailed operational and/or maintenance and troubleshooting instructions. If no solution is found in the manual, contact Spectrace Instruments for assistance.

An instrument log should be maintained to document specific corrective actions taken to alleviate any instrumental problems, or for recording any service that has been performed.

6.0 REAGENTS

Generally, calibration standards are not necessary for site screening and extent of contamination analyses with the Spectrace 9000. Optionally, an application (only the Soil Sample application will be discussed here) can be optimized or verified to be 1:1 proportional to another analytical (reference) method (see Section 9.3 and 10.1). This can be done by analyzing a set of Site-Specific Calibration Standards (SSCS) and performing a regression analysis on the reference (dependent) and the Spectrace 9000 results (independent) for each element of concern. In an application, any element's calibration can be adjusted by entering the desired slope and offset (intercept) in the Adjust Calibration menu. If any element's calibration has been adjusted in an application, "adj" will appear on the results screen. An adjusted element calibration can always be changed back to the initial slope and offset values of 1 and 0, respectively.

6.1 Site-Specific Calibration Standards (SSCS)

SSCS must be representative of the matrix to be analyzed by XRF. The concentration of the target elements in the SSCS should be determined by independent AA or ICP analyses that meet acceptable quality levels for referee data.

6.1.1 SSCS Sampling

See Section 4.2 on sample representivity. The SSCS samples must be representative of the matrix to be analyzed by XRF. It is senseless to collect SSCS samples in the site containment area if you are interested in investigating off-site contaminant migration. The matrices may be different and could affect the accuracy of the XRF results. If there are two different matrices on site, collect two sets of SSCS samples.

A full range of target element concentrations is needed to provide a representative calibration curve. Mixing high and low concentration soils to provide a full range of target element concentrations is not recommended due to heterogeneity problems. Unlike liquid samples, solid samples cannot be diluted and re-analyzed.

Additionally, collect several SSCS samples in the concentration range of interest. If the action level of the site is 500 mg/kg, use of several SSCS samples will tend to improve the XRF analytical accuracy in this concentration range.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 15 of 33
REV: 1.0
DATE: 12/21/92

Generally, a minimum of seven appropriate SSCS samples should be taken. A minimum sample size of 4 oz. is recommended. A larger size sample should be taken to compensate for sites with greater content of nonrepresentative material such as rocks and/or organic debris. Standard glass sampling jars should be used.

6.1.2 SSCS Preparation

The SSCS samples should be either air dried overnight, or oven dried at less than 105° C. Oven drying invalidates mercury analysis. Aluminum drying pans or large plastic weighing boats for air drying may be used. After drying, remove all large organic debris and non-representative material (twigs, leaves, roots, insects, asphalt, rocks, etc.).

The sample should be sieved through a 10-mesh stainless steel sieve. Clumps of soil and sludge should be broken up against the sieve using a stainless steel spoon. Pebbles and organic matter remaining in the sieve should be discarded. The undersize fraction of the material constitutes the sample.

Although a maximum final particle size of 10-mesh is normally recommended, a smaller particle size may be desired. The sample should be mixed by dividing the sieved soil into quarters and physically mixing opposite quarters with a clean stainless steel spoon. Recombine and repeat the quartering and mixing procedure three times. Place the sieved sample in a clean glass sample jar and label it with both the site name and sample identification information.

The stainless steel sieves should be decontaminated using soap and water. They should be dried between samples.

One or more plastic XRF sample cups should be filled with the sieved soil for each SSCS sample. A piece of 0.2-mil polypropylene film should be cut and stretched (wrinkle-free) over the top of the X-ray sample cup and then sealed using the plastic securing ring. The cup should be labeled using both the site name and specimen identification information.

Either the XRF sample cup or the balance of the prepared sample is submitted to the approved laboratory for AA or ICP analysis of the requested element(s).

7.0 PROCEDURE

7.1 Prerequisites

If the Spectrace 9000 will be used in a location where AC power outlets are conveniently accessible, connect the battery charger to the electronic unit and plug the charger cord into the outlet. The probe cable must be connected before switching on the power. Plugging and unplugging this cable with the power on can damage the detector.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 16 of 33
REV: 1.0
DATE: 12/21/92

To connect the battery, set the electronics unit on its face and use a flat blade screwdriver to loosen the two one-quarter turn fasteners on the back. Remove the battery pack. Inside, find the cord with the red cap covering the three-pronged plug. Remove the cap and plug it into the battery pack. Put the battery pack into the unit and tighten the fasteners.

Apply power to the Spectrace 9000 by pressing the <ON> button. The electronic unit may not come on with the battery charger hooked up if the battery has been totally drained. The drained battery may require a 10 minute charge prior to startup. In a few seconds the display shows the version of software. If necessary, adjust the contrast knob located on the underside of the front display. This knob can be turned so far that the display appears blank.

The initial screen displays for about 10 seconds and then a prompt will ask if the time and date are set correctly. The date **MUST** be set correctly otherwise serious errors in source-decay compensation can result. Additionally, results tables include the time and date of analysis. The main menu appears after the time and date screens.

If a "battery low" message appears, recharge or change the battery before proceeding, or operate the unit using line voltage.

Allow the Spectrace 9000 to warm up for approximately 30 minutes after it has been turned on before performing analysis.

7.1.1 Gain Control

Automatic gain compensation is a feature of both Soil and Thin Samples applications, which allows operation of the instrument over a wide range of ambient temperatures and from one day to another without standardization. To maintain gain control compensation, it is necessary to occasionally operate with a minimum acquisition time of 50 seconds on the Cd-109 source. If the automatic gain control fails or is out of range, an error message will appear on the screen. If the error message continues to appear after repeat analyses, then the Cd-109 measurement time should be checked and/or an energy calibration should be performed. If the problem continues, contact Spectrace Instruments for help.

7.1.2 Setting Data and Spectrum Store/Send Mode

The Set store/send modes option is located in the More screen which can be accessed from the main menu. Data and/or Spectrum storage must be enabled for automatic on-board storing to occur. Sufficient memory is available to store up to 300 sets of analysis results and up to 120 spectra (40 samples since each sample has three spectra). When the available memory is full, the respective spectra or results storage mode is automatically disabled. The spectra or results memory must be cleared (deleted) and the respective store mode enabled before results and/or spectra can be stored again.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 17 of 33
REV: 1.0
DATE: 12/21/92

7.2 General Keys and Menu Software

This section outlines the general keys and basic menu software. Flow charts which describe the menu structure in detail are located on pages 4-13 through 4-17 in the Spectrace 9000 Operating Instructions.

7.2.1 The Keyboard

The row of numeric keys under the LCD screen performs functions defined by labels (a menu) written to the bottom line of the display by the Spectrace 9000 software. As the operator moves through the various menus, the keys are redefined to provide an efficient user interface.

The keypad to the right of the screen is used for numeric entry. The <Cont/Pause> key (referred to as the <Cont>) is used:

- to enter information as an <Enter> key
- to begin an analysis
- to pause an analysis in progress

The left arrow <-> key is used to edit entries before pressing <Cont>.

7.2.2 The Measure (Ready) Screen

This main menu selection displays the application name, revision date, measurement time for each source, and accesses other options (see flow diagrams in Spectrace 9000 Operating Instructions).

7.2.3 The Choose an Application Screen

This main menu selection lists the applications currently loaded in the unit. Applications are selected and source measurement times may be modified in this screen (see flow diagrams in Spectrace 9000 Operating Instructions).

7.2.4 The Review Stored Results Screen

This main menu selection lists the stored results. *Up* and *Down* scroll are used on many screens. When *Up* and *Down* are displayed, pressing the <0> (zero) key will toggle to *PgUP* and *PgDN* for rapid movement through long lists. Stored results may be reviewed, deleted, or downloaded to the COM port (see flow diagrams in Spectrace 9000 Operating Instructions).

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 18 of 33
REV: 1.0
DATE: 12/21/92

7.2.5 The Review Stored Spectra Screen

This main menu selection lists the stored spectra which may be deleted or transmitted to the COM port (see flow diagrams in Spectrace 9000 Operating Instructions). You cannot display spectra under this screen. Spectra may be displayed in the *Examine Spectrum* portion of the More screen (accessed from the main menu) or in the *Examine Spectrum* selection from the Results screen under the *More Options* menu selection.

7.2.6 The More (Other Functions) Screen

This main menu selection lists the following functions:

- *Set clock/calendar*
- *Comm. port setup*
- *Set store/send modes*
- *Application maintenance*
- *Examine spectrum*

7.2.7 The Results Screen

The Results screen is displayed at the end of the analysis. If the automatic *Store Results* mode is enabled, you will be prompted for sample identification (*ID*) before the Results screen is displayed. *Up* or *Down* scrolls the screen to view more results. When *Up* and *Down* are displayed, pressing the <0> (zero) key will toggle to *PgUP* and *PgDN* for rapid movement through long lists. *Send* transmits results to the COM port. *Store* prompts for an ID and then stores results in memory. *Measr* will immediately begin another analysis cycle. *Opts* displays the first of two screens listing special options under the Results screen (the second screen is located under *More Opts* of the first screen. See flow diagrams in Spectrace 9000 Operating Instructions). The most frequently used functions are the *Examine Spectrum* and *Enable/Disable Display Thresholds* located on the second screen of options.

7.3 Preoperational Checks

7.3.1 Energy Calibration Check

An energy calibration should be performed after an instrument is shipped and periodically (approximately 2 weeks) to ensure proper energy calibration. The *Energy Calibration* function is located in the *Options* section of the Measure Screen. You will be prompted to place the safety shield on the probe and then initiate a 600-second analysis that will update the X-ray energy calibration.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 19 of 33
REV: 1.0
DATE: 12/21/92

The energy calibration check is performed in the field daily and after an energy calibration to verify proper energy calibration. To perform an energy calibration check, place the safety shield on the probe. Select the *Soil Samples* application and measure the safety shield using a minimum acquisition time of 60 seconds for each source. Save the results and spectra for documentation. Select *Opts, More Options*, and then *Examine Spectrum*. Examine the spectrum of each source. Locate and record the centroid KeV (using the x12 horizontal magnification) for each of the following peaks:

Source	Peak	Theoretical (KeV)	Specification (KeV)
Cd-109	Pb L-alpha	10.54	+/- 0.040
	Pb L-beta	12.61	+/- 0.040
	Pb L-gamma	14.76	+/- 0.040
	Emission peak	22.10	+/- 0.040
Fe-55	S K-alpha	2.31	+/- 0.010
	Emission peak	5.89	+/- 0.010
Am-241	Pb L-alpha	10.54	+/- 0.050
	Pb L-beta	12.61	+/- 0.050
	Emission peak	59.5	+/- 0.20

Perform an *Energy calibration* (see Spectrace 9000 Operating Instructions) and then do another energy calibration check if any of the peaks fail to meet specification. The energy calibration check should be performed once at the beginning of the day, after an energy calibration, after loading an application, and whenever the instrument exhibits a persistent drift.

7.3.2 Resolution Check

The resolution check examines the detector's ability to resolve X-ray energies. This should be performed once at the beginning of the day. Select the *Soil Samples* application, and measure a sample of iron using a minimum acquisition time of 60 seconds for the Cd-109 source. Save the results and spectra for documentation. Select *Examine spectrum* under the More Options section of the Results screen. Examine the Cd-109 spectrum. Locate and record the maximum peak counts (must be >1000 counts) of the iron K-alpha peak (6.4 KeV) using the x12 horizontal magnification (see Figure 2, Appendix A). Divide the maximum peak counts by two. Examine the right side of the peak and record the counts and KeV of the channel with counts less than or equal to one-half the maximum peak count value (channel B, Figure 2). Examine the left side of the peak and record the counts and KeV of the channel with counts less than or equal to one-half the maximum peak count value (channel A, Figure 2). Subtract the left-side KeV from the right-side KeV (KeV at B - KeV at A, Figure 2). The difference should be less than 0.300 KeV. If the unit fails to meet this specification, call Spectrace Instruments for assistance.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 20 of 33
REV: 1.0
DATE: 12/21/92

7.3.3 Blank (Zero) Sample Check

The blank (Zero) sample check is performed to monitor the instrument's zero drift in the selected application. The blank sample check and the *Acquire Background Data* operation (discussed below) only apply to the application currently selected. This should be done once at the beginning of the day, after an energy calibration, after loading an application, and whenever the instrument exhibits a persistent drift on a blank or low-level sample.

Mount the probe in the laboratory stand and select the *Soil Samples* application. Disable the display thresholds. This will permit results less than one standard deviation (STD) to be displayed (even negatives). Measure the quartz blank provided with the unit (or a "clean" sand sample) using a minimum acquisition time of 60 seconds for each source. Review the results table. Most (95%) of the elemental results for elements number 24 (Cr) and higher in the periodic table should be within 2 standard deviations of zero ($0 \pm 2 \cdot |\text{STD}|$), and all of them (99%) should be within 3 standard deviations ($0 \pm 3 \cdot |\text{STD}|$). Repeat the measurement if the unit fails to meet these specifications. If several elements continue to be significantly out of these specifications, check the probe window and the blank sample for contamination or perform the *Acquire background data* operation located in the Measure (Ready) screen option. Perform the blank (Zero) sample check again. Save the results and spectra for documentation. Enable the display thresholds prior to sample analysis after the blank sample check procedure is completed.

7.3.4 Target Element Response Check

The purpose of the target element response check is to ensure that the instrument and the selected application are working properly prior to performing sample analysis. This check should be performed at the beginning of the day. Use low, mid, and high samples, or standards with known concentrations for some or all of the target elements to be checked. Select a low sample near the quantitation limit of the target elements. Select a mid sample near the site action level and a high sample near the maximum concentration of the target elements expected on site.

These samples should be measured using the same source acquisition times that will be used for sample analysis. Save the sample check results and spectra for documentation.

7.4 Selecting Source Measuring Time

The source measuring time may be modified under the Measure screen. Zero (seconds) measuring time should never be selected for any source for any application. Generally, the element detection limit is reduced by 50 percent for every four-fold (x4) increase in source measuring time. Although counting statistics improve as measurement time increases, the

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 21 of 33
REV: 1.0
DATE: 12/21/92

practical limit for typical applications is 600 to 800 seconds. The elements are grouped together according to the radioisotope used for their excitation with typical minimum detection limits shown in Sections 7.4.2. and 7.4.3.

Automatic gain compensation is a feature of both the Soil and Thin Samples applications which allows operation of the instrument over a wide range of ambient temperatures and from one day to another without standardization. To maintain this gain control compensation, it is necessary to occasionally operate with a minimum acquisition time of 50 seconds on the Cd-109 source.

The *Real/live* option toggles between real time (true clock time) and live time (total time the instrument is counting). The latter adds time to the analysis to correct for the time the system is busy processing pulses.

7.4.1 Minimum Source Measuring Times

A minimum measuring time (real or live) of 15 seconds for the Fe-55 source, 30 seconds for the Cd-109 source, and 10 seconds for the Am-241 source is recommended when using the Soil Samples application. Measuring times for a source that excites a target element can be increased if lower detection limits are required.

When using the Thin Samples application, the measuring time for any source may be reduced to 10 seconds if the source does not excite a target element since this application does not correct for interelement effects. If a source excites a target element, a minimum measuring time (real or live) of 60 seconds for the Fe-55 source, 60 seconds for the Cd-109 source, and 120 seconds for the Am-241 source is recommended.

A minimum of 60 seconds is recommended for the Cd-109 source when using the PbK in Paint application.

7.4.2 Typical Minimum Detection Limits (MDLs) for the Soil Samples Application

For source measuring times of 60 seconds, typical element MDLs (in milligram per kilogram, mg/kg) for the Soil Samples application are:

Source	Element	MDL (mg/kg)
Fe-55	Potassium (K)	325
	Calcium (Ca)	150
	Titanium (Ti)	110
	Chromium (CrLo)	180
Cd-109	Chromium (CrHi)	525
	Manganese (Mn)	410

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 22 of 33
REV: 1.0
DATE: 12/21/92

	Iron (Fe)	225
	Cobalt (Co)	205
	Nickel (Ni)	125
	Copper (Cu)	90
	Zinc (Zn)	70
	Mercury (Hg)	60
	Arsenic (As)	50
	Selenium (Se)	35
	Lead (Pb)	30
	Rubidium (Rb)	10
	Strontium (Sr)	10
	Zirconium (Zr)	10
	Molybdenum (Mo)	10
Am-241	Cadmium (Cd)	180
	Tin (Sn)	100
	Antimony (Sb)	65
	Barium (Ba)	20

NOTE: These typical MDLs are provided as an aid for selecting source measurement times; observed values for a given situation may vary depending on the matrix of the soil standard used to calculate MDLs, age of sources, moisture content, and other factors discussed in Section 4.

Generally, the detection limit is reduced by 50 percent for every four-fold (x4) increase in source measuring time. Additionally, more elements may be added to the Soil Samples application. Contact Spectrace Instruments for information about modifications to applications.

7.4.3 Typical Minimum Detection Limits (MDLs) for the Thin Samples Application

For source measuring times of 200 seconds for the Fe-55 and Cd-109 sources, and 800 seconds for the Am-241 source, typical element MDLs (in microgram per square centimeter, $\mu\text{g}/\text{cm}^2$) for the Thin Samples application are:

Source	Element	MDL ($\mu\text{g}/\text{cm}^2$)
Fe-55	Potassium (K)	0.40
	Calcium (Ca)	0.20
	Titanium (Ti)	0.15
	Chromium (CrLo)	0.40
Cd-109	Chromium (CrHi)	0.90
	Manganese (Mn)	0.65
	Iron (Fe)	0.65
	Cobalt (Co)	0.50
	Nickel (Ni)	0.30
	Copper (Cu)	0.65

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 23 of 33
REV: 1.0
DATE: 12/21/92

	Zinc (Zn)	0.40
	Mercury (Hg)	0.45
	Arsenic (As)	0.40
	Selenium (Se)	0.15
	Lead (Pb)	0.50
	Rubidium (Rb)	0.10
	Strontium (Sr)	0.10
	Zirconium (Zr)	0.15
	Molybdenum (Mo)	0.10
Am-241	Cadmium (Cd)	2.5
	Tin (Sn)	2.5
	Antimony (Sb)	1.5
	Barium (Ba)	0.70

NOTE: These typical MDLs are provided as an aid for selecting source measurement times; observed values for a given situation may vary depending on the thin sample standard used to calculate MDLs, age of sources, and other factors discussed in Section 4.

Generally, the detection limit is reduced by 50 percent for every four-fold (x4) increase in source measuring time. Use of thick filters or filters with high background or contamination will result in higher MDLs and require a background subtraction. Additionally, more elements may be added to the Thin Samples application. Contact Spectrace Instruments for information about modifications to applications.

7.5 Sample Handling and Presentation

When making XRF measurements, be sure to maintain constant measurement geometry in order to minimize variations in analysis results. Document any anomalies in measurement geometry, sample surface morphology, moisture content, sample grain size, and matrix (see Section 4.0).

7.5.1 Soil Samples

Soil samples may be analyzed either in-situ or in prepared X-ray sample cups. The Soil Samples application assumes the sample to be infinitely thick. For in-situ measurements this is almost always the case. However, for sample cup measurements it is advisable to fill the cup nearly full and tap it on the bench to compact the soil. This ensures that the sample is as uniformly thick as possible from analysis to analysis. The Spectrace 9000 laboratory stand and safety shield should be used when analyzing sample cups.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 24 of 33
REV: 1.0
DATE: 12/21/92

An area for in-situ analysis should be prepared by removing large rocks and debris. The soil surface should be rendered flat and compact prior to analysis. The Spectrace 9000 probe should be held firmly on the ground to maximize instrument contact with the ground. The probe should not be moved during analysis. Analysis of water saturated soils should be avoided. A thin layer of 0.2-mil polypropylene XRF film may be mounted on the surface probe to minimize contamination. Use of varying thicknesses of plastic (bags) have been shown to interfere in the light element (low atomic number) measurement and may affect the FP calibration of the other element concentrations.⁽²⁾ Additionally, plastic may contain significant levels of target element contamination.

Course-grained soil conditions or nuggets of contaminated material may preclude a truly representative sample and adversely affect the analysis results (typically by under reporting the target element). Such samples should be prepared before analysis. Preparation consistency is important to minimize variation in analytical results.

This application is specifically designed for soil with the assumption that the balance of the material is silica. If samples with a much lighter (lower atomic number) balance are analyzed, the results will typically be elevated by a factor of two to four. Contact Spectrace Instruments for help in analysis of different matrices.

7.5.2 Thin (Filter) Samples

The Thin Samples application is for analysis of thin samples such as filters or wipes. The detection limits are affected by the thickness of the substrate. Best results are obtained on the thinnest substrates. Always use the probe safety cover when measuring thin samples. This is not only for user safety, but also ensures a controlled background environment and provides a reference signal for the automatic gain control. Probe safety covers should never be interchanged between instruments.

Filters and wipes should be prescreened before use to establish background and contamination levels. Care should be used to prevent zinc oxide contamination from disposable gloves. Small 37-mm filters can be mounted between two layers of 0.2-mil thick polypropylene XRF film on 40-mm XRF cups for analysis. Larger filters can be placed on the probe with a sheet of 0.2- mil thick polypropylene XRF film between the filter and probe to prevent the window from being contaminated. Then the probe safety cover may be placed over the filter prior to analysis. Filters should be presented loaded side down and wrinkle free.

7.5.3 Lead in Paint

The area selected for analysis should be smooth, representative and free of surface dirt. The Spectrace 9000 probe should be held firmly on the surface to maximize instrument contact. The probe should not be moved during analysis.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 25 of 33
REV: 1.0
DATE: 12/21/92

When used for specimen application (e.g., on paint chips or nonbacked films) remember to use the probe safety cover. In the PbK Application, you should also position a thick neutral sample, such as the quartz disk (blank), behind the specimen before closing the safety lid. Otherwise, the PbK X-rays excited in the safety cover will be sensed by the detector. In this application, do not perform the *Acquire background data* option from the list of options under the Ready screen.

8.0 CALCULATIONS

The Spectrace 9000 is a direct readout instrument that does not require any calculations.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 Precision

The precision of the method is monitored by reading a low- or mid-target element concentration sample (or SSCS selected as described in Sections 6.1) at the start and end of sample analysis and after approximately every tenth sample. (A daily total of seven measurements is recommended.) Determining the precision around the site action level can be extremely important if the XRF results are to be used in an enforcement action. Therefore, selection of a sample with a target element concentration at or near the site action level or level of concern is recommended. The sample is analyzed by the instrument for the normal field analysis time, and the results are recorded. The standard deviation for each target element is calculated. The relative standard deviation (RSD) of the sample mean can be used to calculate precision. The RSD should be within ± 20 percent for the data to be considered adequately precise.⁽²⁾

9.1.1 Preliminary Minimum Detection Limit (PMDL) and Minimum Quantitation Limit (PMQL)

A preliminary PMDL and PMQL is needed to give the operator an indication of the instrument's capability in the field. A low or blank sample is selected that is representative of the sample matrix. A low or blank SSCS may be selected as described in Section 6.1. Alternatively, the quartz blank or "clean" sand may be used if a blank soil sample is unavailable. More than one standard may be needed to obtain low or blank concentration values for each element. Select the application that will be used for analysis of the samples. Disable the display thresholds to permit display of low or negative results.

The sample is measured 10 times without moving it using the anticipated field analysis measuring time. The sample standard deviation of the mean for each target element is calculated (using the N-1 formula).

If the standard deviation has a fractional component, round up to the next whole number prior to calculating the PMDL and PMQL.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 26 of 33
REV: 1.0
DATE: 12/21/92

The definition of the PMDL is three times the calculated standard deviation value.

The definition of the PMQL is 10 times the calculated standard deviation value.

9.1.2 The Method Minimum Detection Limit (MMDL) and Method Quantitation Limit (MQL)

The MMDL and MQL may be calculated from the measurement of either a low or blank sample, (or a SSCS selected as described in section 6.1), at the start and end of sample analysis, and after approximately every tenth sample (a daily total of seven measurements is recommended). Alternatively, the quartz blank or "clean" sand may be used if a blank soil or sediment sample is unavailable.

Disable the display thresholds. This will permit results less than one standard deviation (STD) to be displayed (even negatives). Measure the sample using the same application and measuring time used for the samples. Enable the display thresholds prior to analyzing the next sample.

The sample standard deviation of the mean for each target element is calculated. If the standard deviation has a fractional component, round up to the next whole number prior to calculating the MMDL and MQL.

The definition of the MMDL is three times the calculated standard deviation value.

The definition of the MQL is 10 times the calculated standard deviation value.

9.2 Reporting Results

All raw XRF data should be reported including the individual results of multiple analyses of samples and sampling points. The average and concentration range of each multiple analysis should also be reported.

A "reported" value for each analysis or average of multiple analyses should be processed in the following manner.

1. Round the value to the same degree of significance contained in the SSCS sample assay values (usually two) if the element's calibration has been adjusted (see Section 6.0).
2. Report all values less than the MMDL as not detected (ND).
3. Flag and note all values greater than or equal to the MMDL and less than the MQL (usually with a "J" next to the reported value).

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 27 of 33
REV: 1.0
DATE: 12/21/92

4. Report all values equal to or greater than the MQL and within the linear calibration range (if the element's calibration has been adjusted [see section 6.0]).
5. Flag and note all values above the linear calibration range (greater than the highest SSCS used in the calibration adjustment procedure) if SSCS were used and the calibration was adjusted.

9.3 Accuracy

Accuracy, relative to a specific digestion method and elemental analysis procedure, is determined by submitting an XRF analyzed sample (prepared sample cups may be submitted) for AA or ICP analysis at a laboratory.

The on-site analysis of soils by XRF instrumentation should be considered a screening effort only (QA1 data). Data derived from the instrument should be used with discretion. Confirmatory analyses on a subset of the screening samples (minimum 10 percent) can be used to determine the quality of the screening data (QA2 data). The confirmation samples should ideally be selected randomly from the sample set and include a number of samples at or near the critical level. The results of the metal analysis (dependent) and the XRF analysis (independent) are evaluated with a regression analysis. The correlation factor (R^2) should be 0.7 or greater.⁽³⁾

XRF results may be multiplied by the slope prior to substitution for metal analysis results in contouring, kriging programs, or removal volume estimates. Correcting the XRF results based on confirmatory analyses should only be undertaken after careful consideration. It must be understood that the confirmatory analysis (AA or ICP) is an estimate of the concentration of metal contamination and is dependent upon the specific instrumentation and sampling methodology used. Since XRF is a total elemental technique, any comparison with referee results must account for the possibility of variable extraction, dependent upon the digestion method used and its ability to dissolve the waste or mineral form in question.

9.3.1 Matrix Considerations

Other types of QA/QC verification should include verification that the instrument calibration is appropriate for the specific site to be assessed. This includes verification of potential multiple soil matrix types that may exist at a site. Matrix differences which affect the XRF measurement include large variations in calcium content, which may be encountered when going from siliceous to calcareous soils, as well as large variations in iron content.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 28 of 33
REV: 1.0
DATE: 12/21/92

10.0 DATA VALIDATION

10.1 Confirmation Samples

Confirmation samples are recommended at a minimum rate of 10 percent and are required if QA2 data objectives have been established for site activities.⁽³⁾ Ideally, the sample cup that was analyzed by XRF should be the same sample that is submitted for AA/ICP analysis. When confirming an in-situ analysis, collect a sample from a 6-inch by 6-inch area for both an XRF measurement and confirmation analysis.

The XRF and metals results are analyzed with a regression analysis using a statistical program such as SAS® or Statgraphics® with the intercept calculated in the regression. The correlation factor between XRF and AA/ICP data must be 0.7 or greater for QA2 data objectives.⁽³⁾

10.2 Recording Results

Record all results and monitoring activities in a laboratory or field notebook. Alternatively, record results electronically on a hard drive or floppy disk.

10.3 Downloading Stored Results and Spectra

Results (analytical reports) and spectra which have been stored in the Spectrace 9000 internal memory should be downloaded and captured in disk files on a PC (see section 5). Spectrace Instruments provides software for this purpose. Additionally, they provide software to prepare results or spectra for importing into a spreadsheet. Refer to the instructions provided with the programs for details on their operation.

Alternatively, other software with terminal data logging capabilities may be used to capture results and spectra to disk files.

After capturing results to a file, print a copy and save both the disk files and the printout for future reference and documentation purposes.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, corporate and/or any other applicable health and safety practices.

12.0 REFERENCES

- ⁽³⁾ U.S. EPA/ERT, "Representative Sampling Guidance, Volume 1 - Soil," November, 1991 (OSWER Directive 9360.4-10).

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 29 of 33
REV: 1.0
DATE: 12/21/92

- (2) Kalnicky, Dennis, "Effects of Thickness Variations on XRF Analyses of Soil Samples When Using Plastic Bags as Measurement Containers," U.S. EPA Contract No. 68-03-3482, March, 1992.
- (3) U.S. EPA/ERT, Quality Assurance Technical Information Bulletin. "Field-Portable X-Ray Fluorescence," Volume 1, Number 4, May, 1991.

13.0 BIBLIOGRAPHY

1. Spectrace 9000 Portable XRF Analyzer Operating Instructions, Revision 0.3, January, 1992.
2. Bernick, Mark , P. Berry, G. Voots, G. Prince, et. al. , "A High Resolution Portable XRF HgI₂ Spectrometer for Field Screening of Hazardous Metal Wastes," Pacific-International Congress on X-ray Analytical Methods, August, 1991.
3. Bernick, Mark "Thin Film Standard Evaluation of the OEI X-MET 880 HEPS Probe and the Spectrace 9000 Field Portable X-ray Fluorescence Analyzers," U.S. EPA Contract No. 68-03-3482, March, 1992.
4. Andreas, C.M. and W. Coakley, "X-ray Fluorescence Spectrometry: Uses and Applications at Hazardous Waste Sites," HMCRI Research and Development Conference, San Francisco, California, February, 1992.
5. P. Berry, S. Little, G. Voots, M. Bernick, G. Prince, "XRF Determination of Lead in Paint, Soil, and Sampled Particulates with Field Portable Instrumentation", American Chemical Society-Division of Environmental Chemistry, August, 1992.
6. Bernick, Mark, D. Idler, L. Kaelin, D. Miller, J. Patel, G. Prince, "An Evaluation of Field Portable XRF Soil Preparation Methods," Second International Symposium on Field Screening Methods for Hazardous and Toxic Chemicals, February, 1991.
7. Dzuby, T. Ed, "X-ray Fluorescence Analysis of Environmental Samples," Ann Arbor Science, 1977, p. 310.
8. Chappell, R., Davis, A., Olsen, R, "Portable X-ray Fluorescence as a Screening Tool for Analysis of Heavy Metals in Soils and Mine Wastes," Proceedings Conference Management of Uncontrolled Hazardous Waste Sites, Washington, D.C., 1986, p 115.
9. Piorek, Stan, Rhodes, J., "A New Calibration Technique for X-ray Analyzers Used in Hazardous Waste Screening," Proceedings 5th National RCRA/Superfund Conference, April 1988, Las Vegas, NV.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 30 of 33
REV: 1.0
DATE: 12/21/92

-
10. "Data Quality Objectives for Remedial Response Activities," EPA/540/G-87/004, March 1987.
 11. Rhodes, J., Stout, J., Schlinder, J., and Piorek, S., "Portable X-ray Survey Meters for *In-Situ* Trace Element Monitoring of Air Particulates," American Society for Testing and Materials, Special Technical Publication 786, 1982, pp. 70 - 82.
 12. Piorek, S., Rhodes, J., "*In-Situ* Analysis of Waste Water Using Portable Pre-concentration Techniques and a Portable XRF Analyzer," Presented at the Electron Microscopy and X-ray Applications to Environmental and Occupational Health Analysis Symposium, Penn. State Univ., Oct. 14 - 17, 1980.
 13. Piorek, S., Rhodes, J., "Hazardous Waste Screening Using a Portable X-ray Analyzer," Presented at the Symposium on Waste Minimization and Environmental Programs within D.O.D., American Defense Preparedness Assoc., Long Beach, CA., April 1987.
 14. "Field-Portable X-Ray Fluorescence," U.S. EPA/ERT Quality Assurance Technical Information Bulletin, Vol. 1, No. 4, May 1991.
 15. Kalnicky, D., "Effects of Thickness Variations on XRF Analyses of Soil Samples When Using Plastic Bags as Sample Containers," U.S. EPA Contract no. 68-03-3482, March, 1992.
 16. Kalnicky, D., "Hazardous Materials Characterization with Field Portable XRF: Observations and Recommendations," U.S. EPA Contract no. 68-03-3482, March, 1992.
 17. Kalnicky, D., "XRF Method Development, Analysis of PCB in Oil Using Field Portable XRF Instrumentation," U.S. EPA Contract no. 68-03-3482, July, 1992.
 18. Kalnicky, D. J., Patel, J., and Singhvi, R., "Factors Affecting Comparability of Field XRF and Laboratory Analyses of Soil Contaminants," presented at the Denver X-ray Conference, Colorado Springs, CO, August, 1992.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE
OPERATING PROCEDURE

SOP: 1713
PAGE: 31 of 33
REV: 1.0
DATE: 12/21/92

APPENDIX A

Figures

SOP #1713

December, 1992

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE
OPERATING PROCEDURE

SOP: 1713
PAGE: 32 of 33
REV: 1.0
DATE: 12/21/92

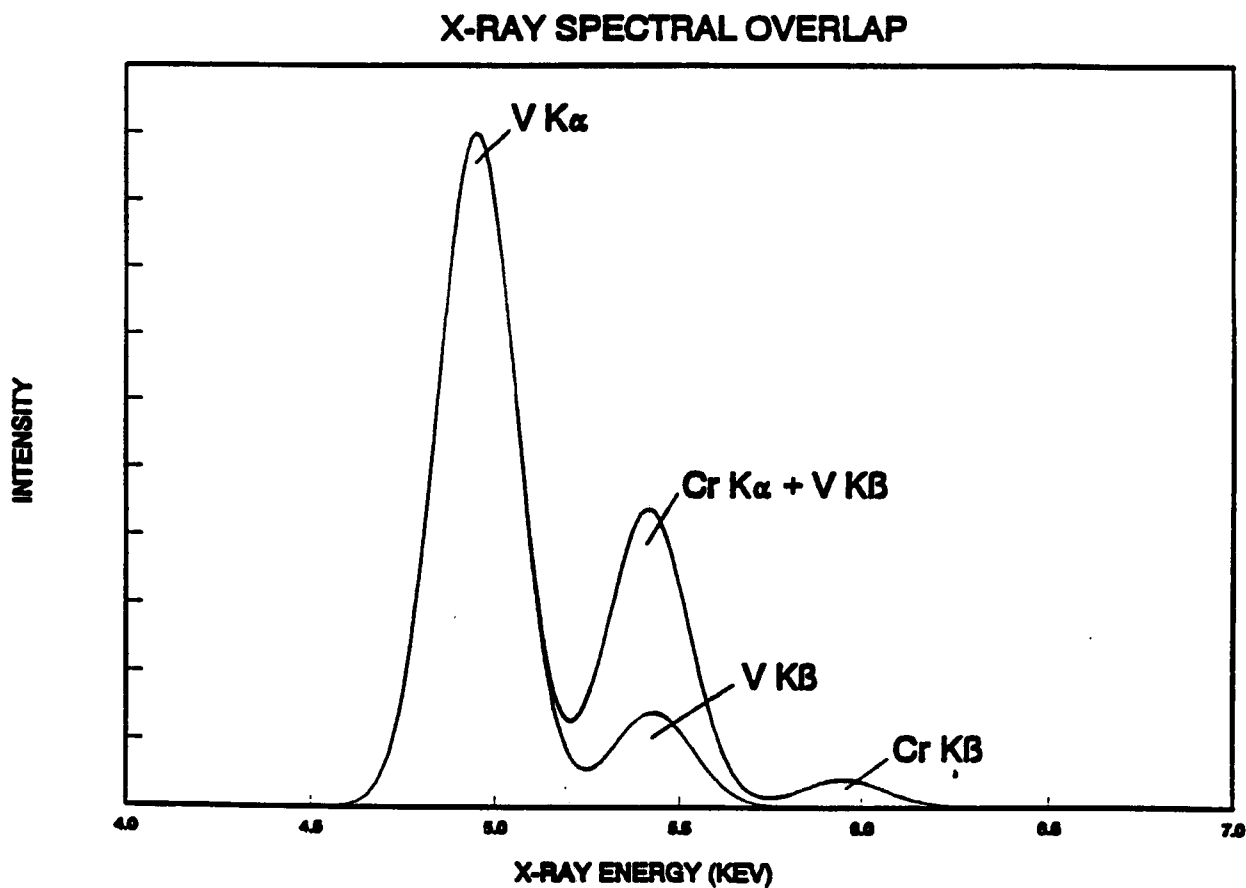


FIGURE 1. X-Ray Spectral Plot Showing Overlap of Vanadium K α X-Rays in the Chromium K α Measurement Region.

U.S. EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

STANDARD OPERATING PROCEDURES

SPECTRACE 9000 FIELD PORTABLE X-RAY FLUORESCENCE OPERATING PROCEDURE

SOP: 1713
PAGE: 33 of 33
REV: 1.0
DATE: 12/21/92

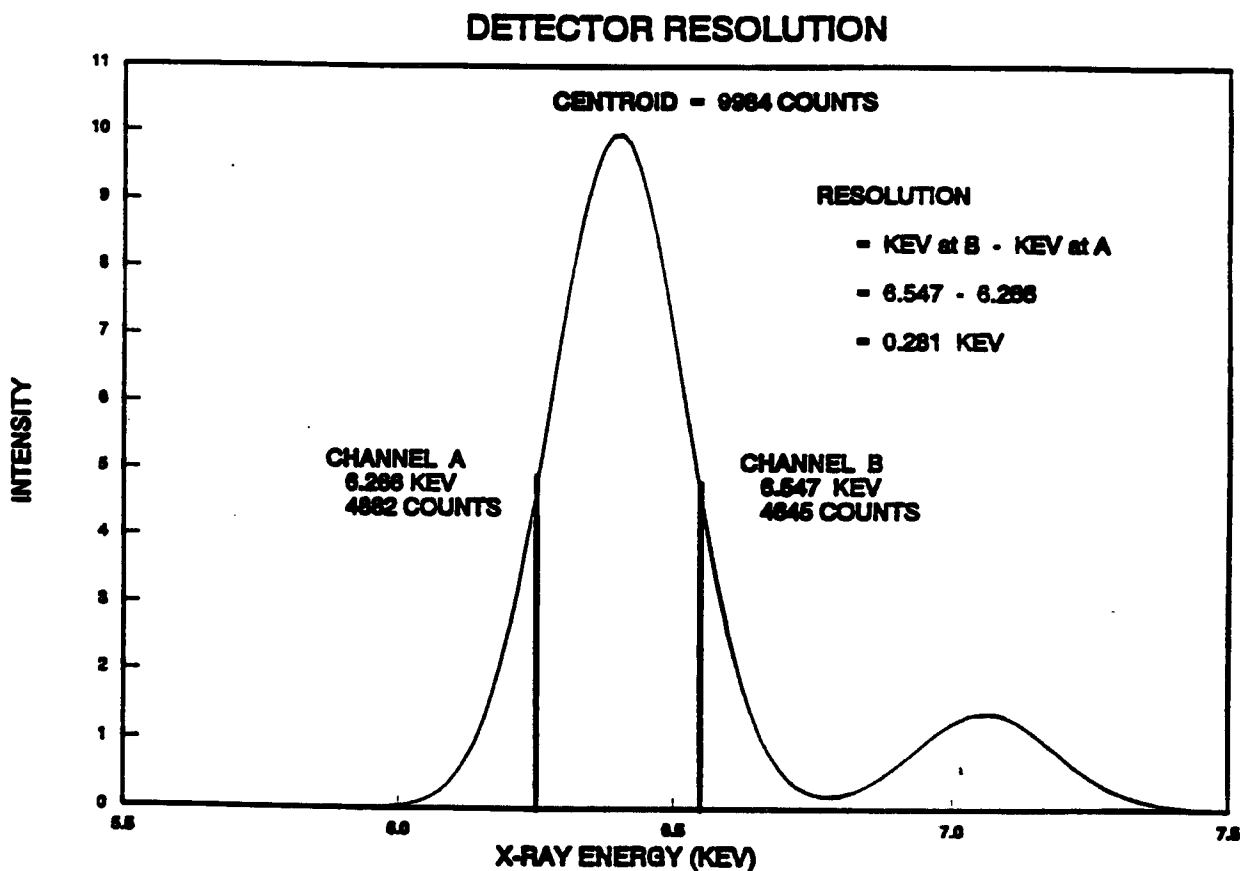


FIGURE 2. Iron X-Ray Spectrum Illustrating Detector Resolution Measurement.



ATTACHMENT B

OPERATING PROCEDURE FOR THE ENSYS IMMUNOASSAY FIELD TESTING KIT

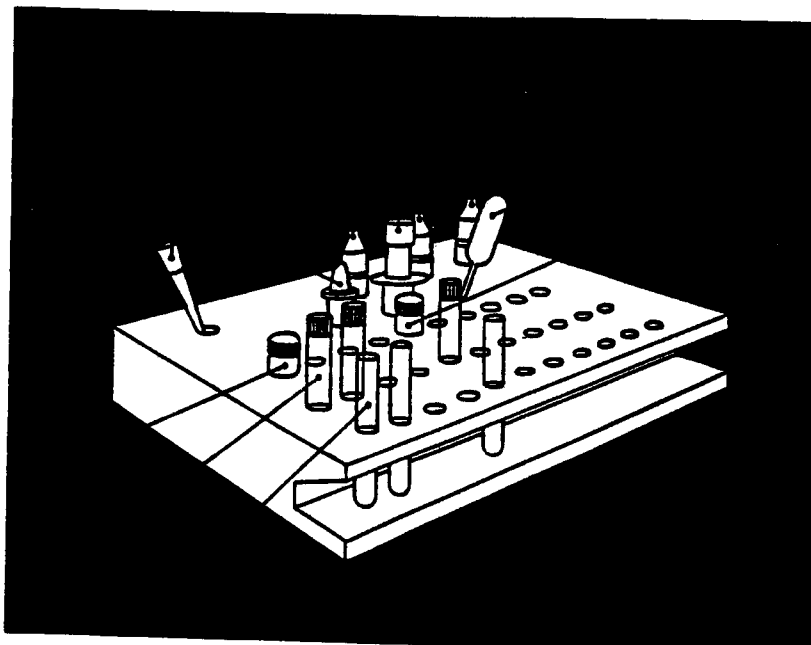
TYPICAL ENSYS IMMUNOASSAY

CTD8/31/92Rev.1

WORKSTATION SET-UP

Assemble the following components in the workstation:

- | | |
|--|--|
| <input type="checkbox"/> 3 antibody coated tubes | <input type="checkbox"/> 3 blue buffer tubes |
| <input type="checkbox"/> PCS standard vial | <input type="checkbox"/> 1 ppm dilution vial |
| <input type="checkbox"/> Enzyme dropper | <input type="checkbox"/> Filtration barrel & plunger |
| <input type="checkbox"/> Bath pipette | <input type="checkbox"/> 2 mechanical pipette tips |
| <input type="checkbox"/> Substrate A | <input type="checkbox"/> Substrate B |
| <input type="checkbox"/> Stop solution | |

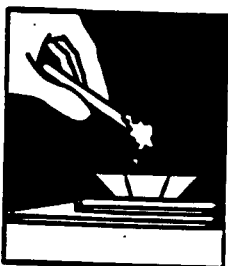


PHASE ONE

**EXTRACTION & PREPARATION
OF THE SAMPLE**

NOTES BEFORE PROCEEDING WITH PHASE ONE

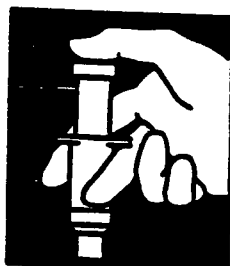
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue, a timer or stopwatch, liquid waste container, and disposable gloves.



- 1** Place weigh boat on pan balance.
- 2** Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.
- 3** Weigh out 10 +/- 0.1 grams of soil.
- 4** If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



- 5** Remove lid from extraction jar and transfer 10 grams of soil from weigh boat into extraction jar.
- 6** Recap extraction jar tightly and shake vigorously for one minute.
- 7** Allow to settle for one minute.



- 8** Remove lid from extraction jar.
- 9** Disassemble filtration plunger from filtration barrel.
- 10** Insert bulb pipette into top (liquid) layer in the extraction jar and draw up sample. Transfer at least 1/4 bulb capacity into filtration barrel. Do not use more than one full bulb.
- 11** Press plunger firmly into barrel until at least 1/4 mL of filtered sample is available (place on table and press if necessary).

Sample is now ready to be tested with the immunoassay.

PHASE TWO

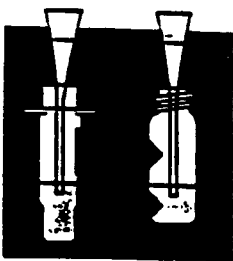
DILUTION & BUFFERING OF SAMPLE & STANDARDS

Following completion of Phase Two steps,
proceed directly with Phase Three.

NOTES BEFORE PROCEEDING WITH PHASE TWO

- Using a permanent marking pen (not included), write **Standard 1** near the top of one blue buffer tube and one antibody coated tube. Then, write **Standard 2** near the top of one blue buffer tube and one antibody coated tube. Place the **Standard** tubes in the workstation.
- **For each sample to be tested:**
Place one 1 **µm** dilution vial in the workstation.
Write 1 **µm** near the top of one blue buffer tube and one antibody coated tube.
For two level test, repeat preceding steps for 10 **µm** dilution vial, using appropriate labels.
- Following instructions on reverse of insert, assemble new tip onto mechanical pipette.
- Avoid withdrawing air bubbles in all pipetting steps.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are **Standards**) at the same time.

DILUTE AND BUFFER SAMPLE

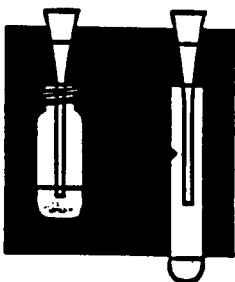


- 12** Remove cap from 1 ppm dilution vial.
- 13** Withdraw 30 μ L of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution vial. Then, withdraw another 30 μ L of filtered sample and dispense below the liquid level into the same 1 ppm dilution vial for a total of 60 μ L; replace cap and gently shake vial for 5 seconds.

FOR TWO LEVEL TEST, INSERT THE FOLLOWING:

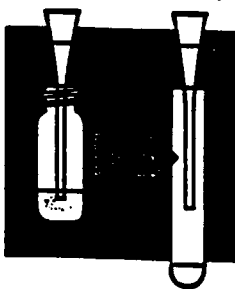
- 13a** Withdraw 30 μ L from the 1 ppm dilution vial using mechanical pipette and dispense below the liquid level in 10 ppm dilution vial. Then, withdraw another 30 μ L from the 1 ppm dilution vial and dispense below the liquid level into the same 10 ppm dilution vial for a total of 60 μ L; replace cap and gently shake vial for 5 seconds.

FOR TWO LEVEL TEST, FROM THIS POINT ON, ALL REFERENCES TO 3 TUBES SHOULD BE REPLACED BY 4 TUBES



- 14** Remove cap from 1 ppm blue buffer tube.
- 15** Withdraw 30 μ L of diluted sample from 10 ppm dilution vial and dispense below the liquid level in 10 ppm blue buffer tube. Do not recap blue buffer tube.
- 15a** Withdraw 30 μ L of diluted sample from 1 ppm dilution vial and dispense below the liquid level in 1 ppm blue buffer tube. Do not recap blue buffer tube.
- 16** Gently shake 1 ppm blue buffer tube for 5 seconds.
- 17** Discard mechanical pipette tip.

BUFFER STANDARDS



- 18** Assemble new tip onto mechanical pipette.
- 19** Remove tops from PCB Standard vial and two blue buffer tubes marked **Standard 1** and **Standard 2**.
- 20** Withdraw 30 μ L of PCB Standard and dispense below the liquid level in **Standard 1** blue buffer tube.
- 21** Wipe pipette tip with laboratory tissue.
- 22** Withdraw 30 μ L of PCB standard and dispense below the liquid level in **Standard 2** blue buffer tube.
- 23** Immediately replace cap on PCB Standard vial.
- 24** Discard mechanical pipette tip.
- 25** Gently shake **Standard 1** and **Standard 2** blue buffer tubes for 5 seconds.

INCUBATION I



26 Start timing and immediately pour solution from each **Standard** blue buffer tube (1 and 2) into appropriate **Standard** antibody coated tube.

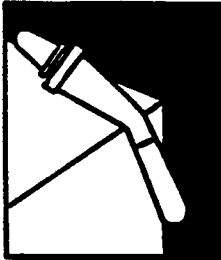
27 Pour solution from 1 **ppm** blue buffer tube into 1 **ppm** antibody coated tube.

27a Pour solution from 10 **ppm** blue buffer tube into 10 **ppm** antibody coated tube.

28 When pouring is complete, gently shake all 3 tubes for 5 seconds.

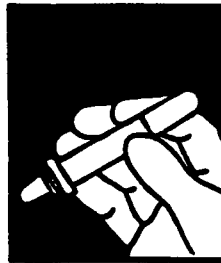
29 Let tubes stand exactly 10 minutes.

PREPARE ENZYME DROPPER



30 Crush glass ampule contained within enzyme dropper by pressing tube against hard edge.

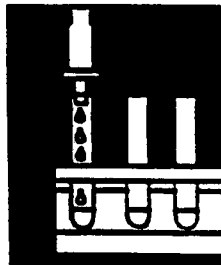
30a Repeat step 30 to prepare one enzyme dropper for every 5 antibody coated tubes.



31 Mix enzyme by turning dropper end-over-end 5 times. Do not shake.

32 Remove seal from enzyme dropper.

INCUBATION II



33 Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.

34 At exactly 10 minutes, start timing and immediately dispense 3 drops into each antibody coated tube (**Standards** and **Sample**) by squeezing the dropper. When complete, gently shake antibody coated tubes for 5 seconds.

35 Let tubes stand exactly 5 minutes.

PHASE THREE

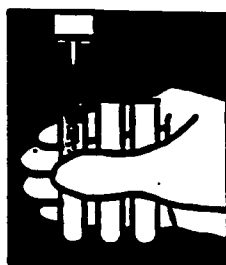
THE IMMUNOASSAY

Note: The timing used in performing Phase Three steps is critical to obtaining accurate test results.

NOTES BEFORE PROCEEDING WITH PHASE THREE

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.
- Instructions to gently shake any of the vials mean to gently but thoroughly mix the contents with special care not to spill or splash.
- All washing must be done thoroughly and with force to remove all unbound material. The wash solution is a harmless, dilute solution of detergent. Do not hesitate to wash vigorously even if the solution contacts gloved hands.

WASH



36 After the 5 minute incubation (a total of 15 minutes), discard solution from each antibody coated tube into liquid waste container.

37 Keeping nozzle of wash solution bottle just above top of antibody coated tube, forcefully squeeze wash solution into each tube with a strong, vigorous stream to fill each tube. Empty all 3 washed tubes into liquid waste container. Repeat wash 3 times (total of 4 washes).

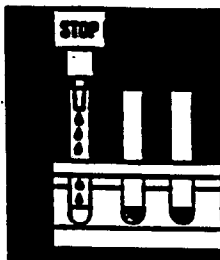
38 After final wash, tap antibody coated tubes upside down on a laboratory tissue.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.

PHASE THREE (CONT.)

COLOR DEVELOPMENT

COLOR DEVELOPMENT



39 Remove top from Substrate A (yellow cap).

Note: Keep Substrate dropper bottles vertical and direct each drop at bottom of antibody coated tubes. Addition of more or less than indicated number of drops (of Substrate A or B) may give inaccurate results.

40 Add 5 drops of Substrate A to each antibody coated tube.

41 Remove top from Substrate B (green cap).

42 Start timing and immediately add 5 drops of Substrate B to each antibody coated tube.

43 Shake all 3 tubes for 3-5 seconds, and let stand for exactly 2 ½ minutes. Solution will turn blue in some or all antibody coated tubes.

44 Stop reaction at end of 2 ½ minutes by adding 5 drops of Stop Solution (red cap).

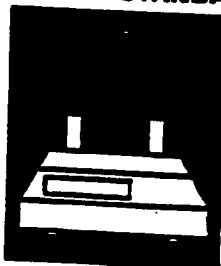
Note: Blue solution will turn yellow when Stop Solution is added.

PHASE FOUR INTERPRETING TEST RESULTS

NOTES BEFORE PROCEEDING WITH PHASE FOUR

- In this step, the standards are evaluated first in order to identify which is darker. To be conservative, the sample will be measured against the darker of these two standards.

SELECT STANDARD



45 Wipe outside of **Standard 1** and **Standard 2** antibody coated tubes with laboratory tissue.

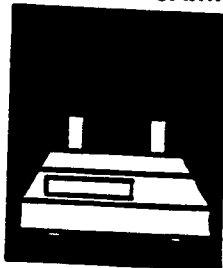
46 Place both **Standard** tubes in photometer.

47 If photometer readout is negative or zero, the tube in the left well is the darker standard. Remove tube from right well and discard it.

However

If photometer reading is positive, the tube in the right well is the darker standard. Remove tube from left well, discard it, and move tube from right well to left well.

MEASURE SAMPLE



48 Wipe outside of **1 ppm** antibody coated tube with laboratory tissue.

49 Place **1 ppm** tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than **1 ppm**.

APPENDIX D

HEALTH AND SAFETY PLAN



L.E. Carpenter - Health and Safety Plan Summary

The attached Health and Safety Plan (HASP) has been prepared in accordance with 29 Code of Federal Regulations (CFR) Part 1910.120 and 29 CFR 1926. This HASP is applicable to all WESTON and subcontractor personnel conducting Remedial Action operations at the L.E. Carpenter and Company facility. Site operations to be performed at the facility during Phase I Remedial Activity include evacuation and disposal of soils that have contaminant concentrations in excess of site specific remedial standards, and collection of additional aquifer characteristic and groundwater contaminant concentration data to support the groundwater pump and treat system remedial design.

The field activities being performed during Phase I of the Remedial Action are summarized as follows:

- Excavate soils associated with four inorganic hot spots. Prior to excavation, the soils will be sampled and analyzed for disposal characteristics. Soils will be excavated, bulked and shipped off-site. Post-excavation field screening and confirmatory sampling will be performed. The excavations are expected to be shallow (less than 2 feet below grade), and will be backfilled and restored to their prior condition.
- Excavate and dispose of the waste material encountered in the disposal area. Prior to excavation, a trenching operation will be conducted to collect disposal characteristic samples. Upon receiving approval from the treatment and disposal facility (TSDF), the non-contaminated surface soil layer will be excavated and stockpiled, and the waste material will be excavated, packaged and shipped off site for disposal. The excavation will remain open, and non-aqueous phase liquid, if encountered will be skimmed from the groundwater. The excavation will be backfilled with soils excavated from the organic hot spots. A pilot infiltration gallery will be installed over the backfilled soil, and the excavation brought to grade with stockpiled surface soil.
- Excavate soils associated with six organic hot spots. Prior to excavation, confirmatory analysis will be performed for hot spot #2, to confirm presence of contaminant. Three of the organic hot spots are shallow, the remaining locations are at depths ranging from 4 to 10 feet (estimated) below grade. Post -excavation sampling and analysis will be conducted. After excavation, soils saturated with product will be packaged for off site disposal, all other organic hot spot soils will be consolidated and placed in the waste disposal area excavation, for future in-situ soils treatment.
- Perform a series of aquifer tests and groundwater chemical analyses to support the groundwater treatment system design. A series of monitoring wells and borings will

be installed. Aquifer tests, including percolation, infiltration, and injection tests, step drawdown tests, and pumping and recovery tests will be conducted to provide the hydrogeophysical data required during design modelling. Groundwater samples will be collected from specific wells and during pumping activities. The samples will be analyzed for water quality parameters and contaminant concentrations to provide an estimate of groundwater treatment system influent characteristics.

- Excavate PCB-contaminated surface soils. The soils will be excavated in shallow (6-12 inches) lifts. Field screening will be performed using immunoassay test kits. If the field screening indicates remedial goals have been met, confirmatory post-excavation sampling will be performed. If goals have not been met, an additional lift will be excavated. Excavation will continue until either remedial goals have been met, or at a maximum depth of two feet below grade. The soils will be sampled for disposal characteristics and shipped off-site for disposal. The excavation will be restored in accordance with the wetlands restoration plan prepared for the site.

Potential risks encountered during field activities include:

- Chemical - contact with site contaminants during sampling, excavating, waste packaging, field screening, drilling, etc.
- Physical - risks associated with heavy equipment, open excavations, ambient heat and cold stress, lifting, housekeeping, rough terrain, etc.; and
- Biological - poisonous plants and stinging insects.

Exposure to these risks will be minimized by use of the appropriate field operations plans and personal protective equipment (PPE).

It is anticipated that two levels of PPE will be utilized for site activities. In general, modified level D (hard hat, safety glasses, safety boots, boot covers, tyvek, surgical gloves, nitrile gloves, and, if necessary, ear plugs) will be used. If field screening indicates a potential respiratory risk, PPE will be upgraded to level C by adding a full face respirator (with the appropriate filter cartridges) to the modified level D work uniform.

Field screening will be used to determine the potential for respiratory risk. A summary of the action level as measured by each field screening instrument and relevant action is tabulated below.

Instrument	Risk	Action Level	Action
CGI/O ₂ meter;	Explosive atmosphere	<10% LEL	Work may continue, consider toxicity potential.
		10% to 25% LEL	Work may continue, increase monitoring frequency.
		>25% LEL	Work must stop. Ventilate area before returning.
CGI/O ₂ meter	Oxygen deficiency	<19.5% O ₂	Leave area. Reenter only with self-contained breathing apparatus.
		19.5% to 23.5% O ₂	Work may continue. Investigate changes from 21%.
		>23.5% O ₂	Work must stop. Ventilate area before returning.
OVM	Organic gases and vapors	≥ 50 ppm in breathing zone	Upgrade to level C PPE.
Miniram	Inorganic vapors and particulates	≥ 2.3 mg/m ³ in breathing zone	Upgrade to level C PPE.
		≥ 2.5 mg/m ³ in breathing zone - PCB area	Upgrade to level C PPE.

This HASP will be used during all Phases of Remedial Actions conducted at the site. The HASP will be modified to incorporate any additional tasks to be performed under subsequent phases of remediation.

SITE HEALTH AND SAFETY PLAN (HASP)

Prepared by:
Harold Hornung

Date: 30 August 1994
W.O. Number: 06720-019-001-0001-00

Project Identification:

Division: MNY
Department/Office: 000562/EDC
Site Name: L.E. Carpenter
Client: L.E. Carpenter
Work Location Address: 120 North Main Street
Wharton, NJ 07885

Site History: (describe briefly)

Wallpaper manufacturing plant from 1942 until 1987; site is inactive; various buildings have been demolished. See project work plan.

Scope of Work: (describe briefly)

Remedial action program:

- 1) Active product recovery using extraction wells to withdraw the water, treat the water through an oil/water separator.
- 2) Groundwater remediation by using shallow wells to pump groundwater, treat it in aboveground bioreactor unit, amend water with oxygen and nutrients and recharge to treatment area.
- 3) Excavate contaminated soil, post excavation sampling, stockpile and dispose of soil properly, backfill with clean fill.

Additional Data collection activities:

- soil boring installation
- groundwater well/extraction well installation
- aquifer testing

☐ Site visit only; site HASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA/SARA

- ☒ US EPA
☒ State
☒ NPL Site
☒ OSHA
☒ 1910
☒ 1926
☒ State

RCRA

- ☐ US EPA
☐ State
☐ NRC
☐ 10 CFR 20

Other Federal Agency

- ☐ DOE
☐ USATHAMA
☐ Air Force

Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

- ☐ Stack Test
☐ Air Emissions
☐ Asbestos
☐ Industrial Hygiene
☒ Hazardous Materials

Review and Approval Documentation:

Reviewed by:

- a. P.M. Martin O'Neill
b. P.D. Martin O'Neill
c. DSO/RSO Harold Hornung
d. SHSC Harold Hornung

Date: 8/31/94
Date: 8/31/94
Date: 8/31/94
Date: 8/31/94

Approved by:

- ☒ Corporate Health and Safety Director (CHSD)
☐ DSO/RSO (Only with specific delegation by CHSD)

Date: 9/20/94

Project start date: 8/1/94
End date: 8/1/95

This site HASP must be
reissued/reapproved for any
activities conducted after: Date
8/1/95

Amendment date(s):

- 1.
- 2.
- 3.
- 4.
- 5.

By:

SITE HEALTH AND SAFETY PLAN (HASP)

Prepared by:
Harold Hornung

Date: 30 August 1994
W.O. Number: 06720-019-001-0001-00

Project Identification:

Division: MNY
Department/Office: 000582/EDC
Site Name: L.E. Carpenter
Client: L.E. Carpenter
Work Location Address: 120 North Main Street
Wharton, NJ 07885

Site History: (describe briefly)

Wallpaper manufacturing plant from 1942 until 1987; site is inactive; various buildings have been demolished. See project work plan.

Scope of Work: (describe briefly)

Remedial action program:

- 1) Active product recovery using extraction wells to withdraw the water, treat the water through an oil/water separator.
- 2) Groundwater remediation by using shallow wells to pump groundwater, treat it in aboveground bioreactor unit, amend water with oxygen and nutrients and recharge to treatment area.
- 3) Excavate contaminated soil, post excavation sampling, stockpile and dispose of soil properly, backfill with clean fill.

Additional Data collection activities:

- soil boring installation
- groundwater well/extraction well installation
- aquifer testing

☐ Site visit only; site HASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA/SARA

☒ US EPA

☒ State

☒ NPL Site

OSHA

☒ 1910

☒ 1926

☒ State

RCRA

☐ US EPA ☐ DOE

☐ State ☐ USATHAMA

☐ Air Force

NRC

☐ 10 CFR 20

Other Federal Agency

Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

☐ Stack Test

☐ Air Emissions

☐ Asbestos

☐ Industrial Hygiene

☒ Hazardous Materials

Review and Approval Documentation:

Reviewed by:

- a. P.M. Martin O'Neill
- b. P.D. Martin O'Neill
- c. DSO/RSO Harold Hornung
- d. SHSC Harold Hornung

Wattson
Harold Hornung
Harold Hornung
Harold Hornung
Date: 8/31/94
Date: 8/31/94
Date: 8/31/94
Date: 8/31/94

Approved by:

Date:

☒ Corporate Health and Safety Director (CHSD)

☐ DSO/RSO (Only with specific delegation by CHSD)

Project start date: 8/1/94
End date: 8/1/95

This site HASP must be reissued/reapproved for any activities conducted after: Date
8/1/95

Amendment date(s):

By:

- 1.
- 2.
- 3.
- 4.
- 5.

WESTON REPRESENTATIVES

Organization/Branch	Name/Title	Address	Telephone
Edison Corporate	Martin O'Neill/Proj. Director	Edison, New Jersey	(908) 417-5800
Edison Corporate	Harold Hornung/Proj. Scientist	Edison, New Jersey	(908) 417-5800
Edison Corporate	Bob Burns/Geologist	Edison, New Jersey	(908) 417-5800
Edison Corporate	Laura Amend/Engineer	Edison, New Jersey	(908) 417-5800
Edison Corporate	Jamie Tittensor/Engineer	Edison, New Jersey	(908) 417-5800
Edison Corporate	Gretchen Chapman/Engineer	Edison, New Jersey	(908) 417-5800
Edison Corporate	Chris Agnew/Scientist	Edison, New Jersey	(908) 417-5800
Edison Corporate	Gerry Ross/Engineer	Edison, New Jersey	(908) 417-5800
5-2	Kevin Hansen/Geologist	West Chester, Pennsylvania	(610) 701-3135
Edison Corporate	John Fix/Geologist	Edison, New Jersey	(908) 417-5800
CRD	Fred Gaglardi/Site Manager	West Chester, Pennsylvania	(610) 701-3000
Roles and Responsibilities: Oversight of drilling subcontractors, oversight of excavating subcontractors, carry out sampling and monitoring tasks.			

WESTON SUBCONTRACTORS

Organization/Branch	Name/Title	Address	Telephone
Roles and Responsibilities:			

SITE SPECIFIC HEALTH AND SAFETY PERSONNEL

The Site Health and Safety Coordinator (SHSC) for activities to be conducted at this site is: Harold Hornung. The SHSC has total responsibility for ensuring that the provisions of this Site HASP are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120

Qualifications: 4 years field experience, OSHA 40-hour and current 8-hour refresher, First Aid/CPR/BBP training, fit test, SHSC training and Level B supervisor training.

Designated alternates include: Laura Amend-Babcock

HEALTH AND SAFETY EVALUATION

Hazard Assessment

Background Review: ☒ Complete ☐ Partial If partial why?

Activities Covered Under This Plan:

No.	Task/Subtask	Description	Schedule
1	Inorganic hot spots	Sample, excavate, dispose of soil, restore site	Mid Sept. - January
2	Waste disposal area	Excavate, sample, package waste, skim product, install pilot infiltration gallery, restore site	Mid Sept. - January
3	Organic hot spots	Sample, excavate, consolidate soil, dispose of saturated soil	Mid Sept. - January
4	Groundwater	Install wells, sample groundwater, perform step draw down test, pump test/recovery test and monitor water levels.	Mid Sept. - January
5	PCB area	Test using ENSYS, excavate, sample, dispose of contaminated soil, restore wetlands (separate plan), and possibly install shallow interceptor trench	Summer 1995

Types of Hazards:

☐ Numbers refer to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical 1 <input checked="" type="checkbox"/> Flammable <input type="checkbox"/> Explosive <input type="checkbox"/> Corrosive <input type="checkbox"/> Reactive <input type="checkbox"/> O ₂ Rich <input type="checkbox"/> O ₂ Deficient	Chemically Toxic 1 <input checked="" type="checkbox"/> Inhalation <input type="checkbox"/> Carcinogen <input checked="" type="checkbox"/> Ingestion <input type="checkbox"/> Mutagen <input checked="" type="checkbox"/> Contact <input type="checkbox"/> Teratogen <input type="checkbox"/> Absorption <input type="checkbox"/> OSHA 1910.1000 Substance <input type="checkbox"/> OSHA Specific Hazard Sub. Standard Describe:	Radiation 3 Ionizing: <input type="checkbox"/> Internal exposure <input type="checkbox"/> External exposure Non-ionizing: <input type="checkbox"/> UV <input type="checkbox"/> IR <input type="checkbox"/> RF <input type="checkbox"/> MicroW <input type="checkbox"/> Laser	Biological 2 <input type="checkbox"/> Etiological Agent <input checked="" type="checkbox"/> Other (Plant, insect, animal) <input checked="" type="checkbox"/> Physical Hazards 4 <input checked="" type="checkbox"/> Construction Activities
--	---	--	---

Source/Location of Contaminants and Hazardous Substances

Directly Related to Tasks <input checked="" type="checkbox"/> Air <input type="checkbox"/> Other Surface <input checked="" type="checkbox"/> Groundwater <input checked="" type="checkbox"/> Soil <input type="checkbox"/> Surface Water <input type="checkbox"/> Other	Indirectly Related to Tasks - Nearby Process(es) That Could Affect Team Members: <input type="checkbox"/> Client Facility <input type="checkbox"/> Nearby Non-client Facility Describe: Site is inactive. <input checked="" type="checkbox"/> Client Briefing Arranged Prior to beginning work.
--	---

HEALTH AND SAFETY EVALUATION - ☐ CHEMICAL HAZARDS

☐ N/A

Chemical Contaminants of Concern

Provide the data requested for chemical contaminants on HASP Form 33HASP.394 or attach data sheets from an acceptable sources such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, etc. List chemical and concentration below and locate data sheets in Appendix A of this HASP.

☐ N/A

Identify hazardous materials used or on-site and attach Material Safety Data Sheets for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all subcontractors and other parties working nearby are informed of the presence of these chemicals and the location of MSDS's. Obtain from subcontractors and other parties lists of the hazardous materials they use or have on-site and identify location of MSDS's here. List chemicals and quantities below and locate MSDS in Appendix B of this HASP.

Chemical Name	Concentration (if known)	Chemical Name	Quantity
Antimony Bis(2-ethylhexyl)phthalate Lead Methylene Chloride* Polychlorinated Biphenyls Xylene* Ethylbenzene	est. 828 ppm max. est. 15,000 ppm max. est. 6530 ppm max. est. 900 ppm max est. 45 ppm max est. 47,000 ppm max est. 14,000 ppm max	Acetone Alconox Rusmor AC-645 10% Nitric	1 gallon 2 boxes 55 gallons 1 liter
* Concentrations listed were detected in disposal area waste samples, collected 1/82.		Note: Concentrations listed were detected in soil samples associated with specific areas of concern in which work will be performed.	

HEALTH AND SAFETY EVALUATION - 2 BIOLOGICAL HAZARDS OF CONCERN

☒ Poisonous Plants

Location/Task No(s): All

Source: ☒ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☒ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ Insects

Location/Task No(s): All

Source: ☒ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☒ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ Snakes, Reptiles

Location/Task No(s): All

Source: ☐ Known ☒ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ Animals

Location/Task No(s):

Source: ☐ Known ☒ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☒ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☐ Sewage

Location/Task No(s):

Source: ☐ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No

Immunization required: ☐ Yes ☐ No

☐ Etiologic Agents (List)

Location/Task No(s):

Source: ☐ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No

Immunization required: ☐ Yes ☐ No

HEALTH AND SAFETY EVALUATION -- 3 RADIATION HAZARDS OF CONCERN

NONIONIZING RADIATION								
Task #	Type of Nonionizing Radiation	Source Onsite	TLV/PEL	Wavelength Range	Control Measures	Monitoring Instrument		
All	Ultraviolet	Sun Light	NA		Sun Block	NA		
	In Frared							
	Radio Frequency							
	Microwave							
	Laser							

IONIZING RADIATION								
				DAC (µCi/mL)				
Task #	Radionuclide	Major Radiations	Radioactive Half-Life (Years)	D	W	Y	Surface Contamination Limit	Monitoring Instrument

HEALTH AND SAFETY EVALUATION - 4 PHYSICAL HAZARDS OF CONCERN

OP(s) Attached	Physical Hazard Conditions	Physical Hazard (Add or delete physical hazards)	Weston OP Titles
<input checked="" type="checkbox"/>	Loud intermittent or continuous noise.	Physiological distress, hearing loss, disruption of communication	FLD01 - Noise Protection
<input checked="" type="checkbox"/>	Ambient heat stress	Heat rash, heat cramps, heat exhaustion, heat stroke	FLD05 - Heat Stress Prevention and Monitoring
<input checked="" type="checkbox"/>	Steam heat stress	Thermal burns, displaced oxygen, and wet working surfaces	FLD03 - Hot Process - Steam
<input type="checkbox"/>	LT3 and Incinerator Heat Stress	Thermal burns from hot surfaces, hot hydraulic line fluids, low pressure steam	FLD04 - Hot Process - Low Temperature Thermal and Transportable Incinerator
<input checked="" type="checkbox"/>	Cold Stress	Hypothermia, frostbite	FLD06 - Cold Stress
<input checked="" type="checkbox"/>	Inclement weather	Rain, wet weather, high humidity, cold, ice, snow, lightning	FLD02 - Inclement Weather
<input checked="" type="checkbox"/>	Cold/wet	Trench foot, paddy foot, immersion foot, edema	FLD07 - Wet Feet
<input type="checkbox"/>	Confined spaces	Asphyxiation, falls, burns, drowning, engulfment, toxic exposure, electrocution	FLD08 - Confined Space Entry
<input type="checkbox"/>	Explosive vapors and ignition source	Thermal burns, impaction, dismemberment	FLD09 - Hot Work
<input checked="" type="checkbox"/>	Improper lifting	Cuts, pinches, crushing, back strain, abdomen, arm, leg muscle, and joint injury	FLD10 - Manual Lifting/Handling of Heavy Objects
<input checked="" type="checkbox"/>	Uneven walking and driving surfaces	Vehicle accidents, slips, trips, and falls	FLD11 - Rough Terrain
<input checked="" type="checkbox"/>	Poor housekeeping	Slips, trips, falls, punctures, cuts and fires	FLD12 - Housekeeping
<input type="checkbox"/>	Structural integrity	Crushing, overhead hazards, compromised floors	FLD13 - Structural Integrity
<input type="checkbox"/>	Hostile persons	Bodily injury	FLD14 - Site Security
<input checked="" type="checkbox"/>	Remote Area	Slips, trips and falls, back strain, communication	FLD15 - Remote Area
<input type="checkbox"/>	Improper cylinder handling	Mechanical injury, fire, explosion and suffocation	FLD16 - Pressure Systems - Compressed
<input type="checkbox"/>	Water Hazards	Poor visibility, entanglement, drowning, cold stress	FLD17 - Diving
<input type="checkbox"/>	Water Hazards	Drowning, back stress, heat stress, cold stress, hypothermia, falling	FLD18 - Operation and Use of Boats
<input checked="" type="checkbox"/>	Water Hazards	Drowning, frostbite, hypothermia, falls, electrocution	FLD19 - Working Over Water
<input checked="" type="checkbox"/>	Vehicle Hazards	Struck by vehicle, collision	FLD20 - Traffic
<input type="checkbox"/>	Explosions	Explosion, fire, thermal burns	FLD21 - Explosives
<input checked="" type="checkbox"/>	Moving mechanical parts	Crushing, pinch points, overhead hazards, electrocution	FLD22 - Heavy Equipment Operation
<input checked="" type="checkbox"/>	Moving mechanical parts	Overhead hazard, electrocution	FLD23 - Cranes/Lifting Equipment Operation
<input type="checkbox"/>	Working at elevation	Overhead hazards, falls, electrocution	FLD24 - Aerial Lifts/Manlifts
<input type="checkbox"/>	Working at elevation	Overhead hazard, falls, electrocution	FLD25 - Working at Elevation
<input type="checkbox"/>	Working at elevation	Overhead hazard, falls, electrocution, slips	FLD26 - Ladders
<input type="checkbox"/>	Working at elevation	Slips, trips and falls, overhead hazards	FLD27 - Scaffolding
<input checked="" type="checkbox"/>	Trench Cave-in	Crushing, falling, overhead hazard, suffocation	FLD28 - Excavating/Trenching
<input checked="" type="checkbox"/>	Improper material handling	Back injury, crushing from load shifts	FLD29 - Materials Handling
<input type="checkbox"/>	Physiochemical	Explosions, fires from oxidizing, flammable and corrosive materials	FLD30 - Hazardous Materials Use and Storage
<input checked="" type="checkbox"/>	Physiochemical	Fire and explosion	FLD31 - Fire Prevention/Response Plan Required
<input checked="" type="checkbox"/>	Physiochemical	Fire	FLD32 - Fire Extinguishers Required
<input type="checkbox"/>	Structural integrity	Overhead, electrocution, slips, trips, falls, fire	FLD33 - Demolition
<input checked="" type="checkbox"/>	Electrical	Electrocution, shock, thermal burns	FLD34 - Utilities
<input type="checkbox"/>	Electrical	Electrocution, shock, thermal burns	FLD35 - Electrical Safety
<input type="checkbox"/>	Impact/thermal	Thermal burn, high pressure impaction, heat stress	FLD37 - High Pressure Washers
<input checked="" type="checkbox"/>	Impaction/electrical	Smashing body parts, pinching, cuts, electrocution	FLD38 - Hand Tools and Power Tools
<input type="checkbox"/>	Poor visibility	Slips, trips, falls	FLD39 - Illumination
<input type="checkbox"/>	Fire/Explosion	Thermal burns, impaction, pressurized or energized lines	FLD40 - Storage Tank Removal and Decommissioning
<input checked="" type="checkbox"/>	Drilling hazards	Electrocution, overhead hazards, pinch points, decapitation, noise	2.5 - Drilling Safety Guide

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

1 - Inorganic hot spots: Waste Characterization Sampling, excavation, disposal and restoration.

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Tape measure, camera, shovel, trowels, bowls, coolers, ice, tape, alconox, brushes, buckets, water, excavator, XRF screening kit, miniram, OVM, CGI/O² meter, vapor suppressant foam machine, poly, possible roll off or dump truck, grass seed, hard hat, safety glasses, safety boots, tyvex, booties, surgicals, duct tape, nitriles, possible respirator.

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Areas of excavations are known to have inorganic contamination (Pb, Sb). If monitoring indicates airborne particulates above 2.3 mg/m³ or organic vapors \geq 50 ppm in breathing zone will upgrade to Level C.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Working in close proximity to excavator, uneven terrain created by excavating and potential for work in inclement or stressful weather conditions (i.e., heat/cold).

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? Poison ivy and various pest (mosquitos, bees, spiders) may be present.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What Justifies Risk Level?

LEVELS OF PROTECTION/JUSTIFICATION

Will begin work in modified Level D (hard hat, safety glasses, safety boots, tyvex, booties, and ear plugs, if necessary). Will upgrade to Level C if miniram readings are above 2.3 mg/m³ or if readings on the OVM \geq 50 units sustained in the breathing zone and methylene chloride is not present (using Detector Tube). If methylene chloride is present evacuate site and only reenter in Level B.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Noise protection, heat stress prevention and monitoring, cold stress, inclement weather, manual lifting/handling of heavy objects, rough terrain, heavy equipment operation and hand tools and power tools. A copy of the WESTON Safety Officer's field manual will be kept on site.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

2 - Waste disposal area: Excavation, waste characteristic sampling, waste packaging/disposal, product skimming, backfill with organic hot spots, install pilot infiltration gallery, replace surface soils and restore area; perform percolation tests; may need to reposition caisson well.

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Tape measure, camera, shovel, trowels, bowls, coolers, ice, tape, alconox, brushes, buckets, water, excavator, OVM, CGI/O₂ meter, vapor suppressant foam machine, poly, grass seed, hard hat, safety glasses, safety boots, tyvex, booties, surgicals, duct tape, nitriles, possible respirator, rolloff drums or 1 yd³ boxes (as specified by TSDF), skimmer pumps, drill rig, hoses, frac tank, slotted PVC piping, geotech membrane and crushed stone.

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Area of excavation is known to have product in the soil and on the groundwater. Monitoring with OVM and CGI/O₂ meter and use of vapor suppressant foam (if necessary) while excavating.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Working in close proximity to excavator and excavation will be necessary. The excavation will be properly sloped. Personnel will wear proper PPE while packaging waste. May be required to work in inclement weather.

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? Poison ivy and various pest (mosquitos, bees, spiders) may be present.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What Justifies Risk Level?

LEVELS OF PROTECTION/JUSTIFICATION

Will begin work in modified Level D (hard hat, safety glasses, safety boots, tyvex, booties, and ear plugs, if necessary). Will upgrade to Level C if miniram readings are above 2.3 mg/m³ or if readings on the OVM ≥ 50 units sustained in the breathing zone and methylene chloride is not present (using Detector Tube). If methylene chloride is present evacuate site and only reenter in Level B.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Noise protection, heat stress prevention and monitoring, cold stress, inclement weather, manual lifting/handling of heavy objects, rough terrain, heavy equipment operation, hand tools and power tools, and drill rig safety. A copy of the WESTON Safety Officer's field manual will be kept on site.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

3 - Organic Hot Spots: Excavation and consolidation of contaminated soils, post excavation sampling, restoration of area and saturated soil disposal.

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Tape measure, camera, shovel, trowels, bowls, coolers, ice, tape, alconox, brushes, buckets, water, excavator, OVM, CGI/O₂ meter, vapor suppressant foam machine, poly, grass seed, hard hat, safety glasses, safety boots, tyvex, booties, surgicals, duct tape, nitriles, possible respirator, rolloffs, drums or 1 yd³ boxes (as specified by TSDF).

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Area of excavation is known to have product in the soil and on the groundwater. Monitoring with OVM and CGI/O₂ meter and use of vapor suppressant foam will occur while excavating.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Working in close proximity to excavator and excavation will be necessary. The excavation will be properly sloped. Personnel will wear proper PPE while packaging waste. May be required to work in inclement weather.

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? Poison ivy and various pest (mosquitos, bees, spiders) may be present.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What Justifies Risk Level?

LEVELS OF PROTECTION/JUSTIFICATION

Will begin work in modified Level D (hard hat, safety glasses, safety boots, tyvex, booties, and ear plugs, if necessary). Will upgrade to Level C if miniram readings are above 2.3 mg/m³ or if readings on the OVM \geq 50 units sustained in the breathing zone and methylene chloride is not present (using Detector Tube). If methylene chloride is present evacuate site and only reenter in Level B.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Noise protection, heat stress prevention and monitoring, cold stress, inclement weather, manual lifting/handling of heavy objects, rough terrain, heavy equipment operation and hand tools and power tools, and drill rig safety. A copy of the WESTON Safety Officer's field manual will be kept on site.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

4 - Additional data collection - Install wells, sample groundwater, step draw down test, pump test/recovery tests, infiltration test, injection tests, and water level monitoring.

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Water level meter, Grundfoss pump, Johnson Keck pump, frac tank, drill rig, potable water, coolers, ice, tape, alconox, brushes, buckets, DI water, acetone, nitric, spray bottles, bailers, poly coated stainless steel wire, OVM, vapor suppressant foam machine, poly, hard hat, safety glasses, safety shoes, tyvex, booties, surgicals, nitriles, duct tape and respirator.

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? A product layer is known to exist on the groundwater throughout areas of the site. Continuous air monitoring will occur and appropriate use of action levels to dictate PPE use.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Working around drill rig. Possibly working in inclement weather. Lifting heavy pumps and other equipment.

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? Poison ivy and various pest (mosquitos, bees, spiders) may be present.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What Justifies Risk Level?

LEVELS OF PROTECTION/JUSTIFICATION

Will begin work in modified Level D (hard hat, safety glasses, safety boots, tyvex, booties, and ear plugs, if necessary). Will upgrade to Level C if miniram readings are above 2.3 mg/m³ or if readings on the OVM \geq 50 units sustained in the breathing zone and methylene chloride is not present (using Detector Tube). If methylene chloride is present evacuate site and only reenter in Level B.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Noise protection, heat stress prevention and monitoring, cold stress, inclement weather, manual lifting/handling of heavy objects, rough terrain, hand tools and power tools, and drill rig safety. A copy of the WESTON Safety Officer's field manual will be kept on site.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

5 - PCB area: Excavation, waste characteristic sampling, ENSYS testing, possibly install shallow interceptor trench for separate phase LNAPL, restore wetlands and dispose of containerized soils.

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Tape measure, camera, shovel, trowels, bowls, coolers, ice, tape, alconox, brushes, buckets, water, excavator, miniram, OVM, CGI/O² meter, vapor suppressant foam machine, poly, possible roll off or dump truck, grass seed, hard hat, safety glasses, safety boots, tyvex, booties, surgicals, duct tape, nitriles, possible respirator.

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Area is known to have PCB contamination and possible xylene and DEHP contamination. Will don proper PPE and monitor with both OVM and miniram.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Areas of excavations are known to have PCB contamination. If monitoring indicates airborne particulates above 2.5 mg/m³ or organic vapors \geq 50 ppm in breathing zone will upgrade to Level C.

BIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? Poison ivy and various pest (mosquitos, bees, spiders) may be present.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What Justifies Risk Level?

LEVELS OF PROTECTION/JUSTIFICATION

Will begin work in modified Level D (hard hat, safety glasses, safety boots, tyvex, booties, and ear plugs, if necessary. Will upgrade to Level C if miniram readings are above 2.3 mg/m³ or if readings on the OVM \geq 50 units sustained in the breathing zone and methylene chloride is not present (using Detector Tube). If methylene chloride is present evacuate site and only reenter in Level B.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Noise protection, heat stress prevention and monitoring, cold stress, inclement weather, manual lifting/handling of heavy objects, rough terrain, hand tools and power tools, and drill rig safety. A copy of the WESTON Safety Officer's field manual will be kept on site.

SITE OR PROJECT HAZARD MONITORING PROGRAM

Direct Reading Air Monitoring Instruments

Instrument Selection and Initial Check Record

Reporting Format: ☒ Field Notebook ☐ Field Data Sheets ☐ Air Monitoring Log ☐ Trip Report ☐ Other

Instrument	Task No.(s)	Number Required	Number Received	Checked Upon Receipt	Comment	Initials
<input type="checkbox"/> CGI				<input type="checkbox"/>		
<input type="checkbox"/> O ₂				<input type="checkbox"/>		
<input checked="" type="checkbox"/> CGI/O ₂	1,2,3,5			<input type="checkbox"/>		
<input type="checkbox"/> CGI/O ₂ /tox-PPM, H ₂ S,H ₂ S/CO				<input type="checkbox"/>		
<input type="checkbox"/> RAD-GM				<input type="checkbox"/>		
<input type="checkbox"/> NaI				<input type="checkbox"/>		
<input type="checkbox"/> ZnS				<input type="checkbox"/>		
<input type="checkbox"/> Other				<input type="checkbox"/>		
<input checked="" type="checkbox"/> PID	1-5			<input type="checkbox"/>		
<input type="checkbox"/> HNU 10.2				<input type="checkbox"/>		
<input type="checkbox"/> HNU 11.7				<input type="checkbox"/>		
<input type="checkbox"/> Photovac, TMA				<input type="checkbox"/>		
<input checked="" type="checkbox"/> OVM				<input type="checkbox"/>		
<input type="checkbox"/> Other				<input type="checkbox"/>		
<input type="checkbox"/> FID				<input type="checkbox"/>		
<input type="checkbox"/> FOX 128				<input type="checkbox"/>		
<input type="checkbox"/> Heath, AID, Other				<input type="checkbox"/>		
<input checked="" type="checkbox"/> RAM, Mini-RAM, Other	1, 5			<input type="checkbox"/>		
<input type="checkbox"/> Monitox-HCN				<input type="checkbox"/>		
<input type="checkbox"/> H ₂ S				<input type="checkbox"/>		
<input type="checkbox"/> COCL				<input type="checkbox"/>		
<input type="checkbox"/> SO ₂				<input type="checkbox"/>		
<input type="checkbox"/> Other				<input type="checkbox"/>		
<input type="checkbox"/> Bio-Aerosol Monitor				<input type="checkbox"/>		
<input type="checkbox"/> Detector Tubes				<input type="checkbox"/>		
<input type="checkbox"/> Pump - MSA, Dräger, Sensidyne				<input type="checkbox"/>		
<input type="checkbox"/> Tubes/type:				<input type="checkbox"/>		
<input type="checkbox"/> Tubes/type:				<input type="checkbox"/>		
<input type="checkbox"/> Other				<input type="checkbox"/>		

[illegible]

SITE AIR MONITORING PROGRAM

Direct Reading Air Monitoring Instruments

Air Monitoring Instrument: OVM and miniram

- ☐ Periodically:
☒ Continuously: Breathing zone
☐ Other:

Monitoring Locations

- ☒ Upwind/downwind of site activities
☐ Near residents, etc.
☒ Key site activity locations:
 ☐ Decon area
 ☒ Staging area
 ☒ Excavation area
 ☐ Field lab area
 ☐ Storage tanks
 ☐ Lagoons
 ☐ Drums
☐ Fixed stations
☒ Other: Well head space, sample locations

Air Monitoring Instrument: CGI/O₂

Air Monitoring Frequency:

- ☒ Periodically:
☐ Continuously:
☐ Other:

Monitoring Locations

- ☐ Upwind/downwind of site activities
☐ Near residents, etc.
☐ Key site activity locations:
 ☐ Decon area
 ☐ Staging area
 ☒ Excavation area
 ☐ Field lab area
 ☐ Storage tanks
 ☐ Lagoons
 ☐ Drums
☐ Fixed stations
☐ Other:

SITE AIR MONITORING PROGRAM				
Action Levels				
These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.				
Tasks	Action Level		Action	
<input checked="" type="checkbox"/> Explosive atmosphere		Ambient Air Concentration	Confined Space Concentration	
	<10% LEL		0 to 1% LEL	Work may continue. Consider toxicity potential.
	10 to 25% LEL		1 to 10% LEL	Work may continue. Increase monitoring frequency.
	>25% LEL		>10% LEL	Work must stop. Ventilate area before returning.
<input checked="" type="checkbox"/> Oxygen		Ambient Air Concentration	Confined Space Concentration	
	<19.5% O ₂		<19.5% O ₂	Leave Area. Re-enter only with self-contained breathing apparatus.
	19.5% to 25% O ₂		19.5% to 23.5% O ₂	Work may continue. Investigate changes from 21%.
	>25% O ₂		>23.5% O ₂	Work must stop. Ventilate area before returning.
<input type="checkbox"/> Radiation	< 3 times background 3 Times Background to < 1 mR/hour > 1 mrem/hour			Continue Work Radiation above background levels (normally 0.01-0.02 mR/hr) signifies possible source(s) radiation present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist. Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
<input checked="" type="checkbox"/> Organic gases and vapors	≥ 50 ppm on OVM in breathing zone			Upgrade to Level C
<input checked="" type="checkbox"/> Inorganic gases and vapors and particulates	≥ 2.3 mg/m ³ on miniram in breathing zone			Upgrade to Level C

SITE AIR MONITORING PROGRAM

Ambient Air Sampling

Check situations which will require or action levels which will apply to deciding to institute or increase scope of planned air sampling.

- ☒ No air sampling is required on this site.
☐ An air sampling plan is incorporated in this HASP.

Meteorological Conditions

- ☐ Dry weather for ____ days
☐ Ambient temperature above ____ °F
☐ Wind increasing potential of more contaminant dispersion in or migration out of controlled area.

Activities which will require instituting or increasing scope of air sampling:

- ☐ Major spills
☐ New site activity resulting in potential presence of new chemical hazards.
☐ Site activity increases airborne contaminants possibilities.
☐ Air sampling documentation required for:
☐ Downgrading from stipulated level of protection
☐ Documenting no migration of contaminants offsite through air

Applicable Action Levels for instituting Air Sampling:

- ☐ Visible vapor/gas clouds or vapor levels, or
☐ Visible dust or particulate levels measured with Direct Reading Instrument, two-three times background or above action level, sustained over 10-15 minute period.

The following requirements apply to air sampling:

Sampling Matrix/Air Interface - Monitor matrix/air interface and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor continuously. Follow No. 4.

Container Opening - Monitor opening and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor opening and breathing zone continuously. Follow No. 4.

Excavation/Drilling/Intrusive Work - Monitor at ground level and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor opening and breathing zone continuously. Follow No. 4.

Breathing Zone - Ensure level of protection specified in HASP is being used. Consult HASP or Corporate Health and Safety relative to instituting personnel, area, or perimeter sampling.

- ☐ Other

SITE AIR MONITORING PROGRAM

Work Location Instrument Readings

Location:

% LEL	% O ₂	PID (units)	FID (units)	Aerosol Monitor (mg/m ³)	GM: Shield Probe/Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

Location:

% LEL	% O ₂	PID (units)	FID (units)	Aerosol Monitor (mg/m ³)	GM: Shield Probe/Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

CONTINGENCIES**Emergency Contacts and Phone Numbers**

Agency	Contact	Phone Number
Local Medical Emergency Facility	Dover General Hospital	(201) 989-3200
WESTON Medical Emergency Contact	EMR - Dr. Barnes	1-800-229-3674
WESTON Health and Safety	George Crawford	(610) 701-7406 or (610) 692-3030
Fire Department	Wharton Borough	(201) 366-1484
Police Department	Wharton Borough	(201) 366-1050
Onsite Coordinator	Dave Condon	(201) 366-9577
Site Telephone	Ken Radcliff	(201) 366-2020
Nearest Telephone	Mobile Phone	TBA

Local Medical Emergency Facility(s)

Name of Hospital: Dover General Hospital

Address: Jardine Street Dover, New Jersey

Phone No.: (201) 989-3200

Name of Contact: Mary Smith (Head Nurse)

Phone No.: (201) 989-3200

Type of Service:

- ☐ Physical trauma only
- ☐ Chemical exposure only
- ☒ Physical trauma and chemical exposure
- ☒ Available 24 hours

Route to Hospital (written detail):

Take Main Street 2 miles. Make a left (at light) onto 46th Street.
Make a quick right onto St. Mary's Street and a left onto Jardine Street.

Travel time from site:

15 minutes

Distance to hospital:

2.3 miles

Name/No. of 24-hr

Ambulance Service: 911

Secondary or Specialty Service Provider

Name of Hospital:

Address:

Phone No.:

Name of Contact:

Phone No.:

Type of Service:

- ☐ Physical trauma only
- ☐ Chemical exposure only
- ☐ Physical trauma and chemical exposure
- ☐ Available 24 hours

Route to Hospital (written detail):

Travel time from site:

Distance to hospital:

Name/No. of 24-hr

Ambulance Service:

**FIGURE
ROUTE TO HOSPITAL**

CONTINGENCIES				
Response Plans				
Medical - General Provide First Aid as trained, assess and determine need for further medical assistance, Transport or arrange for transport after appropriate decontamination	First Aid Kit:	Type	Location	Special First Aid Procedures: Cyanides on site <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No. If yes, contact LMF. Do they have antidote kit? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	Eyewash required <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Type	Location	HF on site <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No. If yes, need neutralizing ointment for FA kit. Contact LMF.
	Eyewash required <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Type	Location	
Plan for Response to Spill/Release		Plan for Response to Fire/Explosion		Fire Extinguishers
In the event of a spill or release, ensure safety, assess situation and perform containment and control measures as appropriate:	a. Clean up per MSDS if small or; Sound Alarm, call for assistance, Notify Emergency Coordinator b. Evacuate to pre-determined safe place c. Account for personnel d. Determine if can respond safely e. Mobilize per Site Spill Response Plan	In the event of a fire or explosion, ensure personal safety, assess situation and perform containment and control measures as appropriate:	a. Sound Alarm and call assistance, Notify Emergency Coordinator b. Evacuate to pre-determined safe place c. Account for personnel d. Use fire extinguisher, <u>only if safe and trained</u> e. Standby to inform Emergency responders of materials and conditions	Type Location
Description Spill Response Gear	Location	Description (Other Fire Response Equipment)		Location
Sorbent pads	Storage shed			
Plan to Response to Security Problems Keep all equipment in sight or locked in field vehicle. Notify local police in the event of theft or vandalism.				

DECONTAMINATION PLAN

Personnel Decontamination

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each Level of Protection are attached.

Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐ Level B

☐ Level C

☒ Level D

Modifications include: Tyvek, surgical gloves, nitriles, booties

Disposition of Decontamination Wastes

Provide a description of waste disposition including identification of storage area, hauler, and final disposal site, if applicable:

All wastes will be bagged and left on site in labeled drums. The drums will be disposed of at the end of the project.

Equipment Decontamination

A procedure for decontamination steps required for non-sampling equipment and heavy machinery follows:

Heavy machinery will be steam cleaned prior to use, between locations and prior to departing site.

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

Soils - alconox wash, tap water rinse, DI rinse

Waters - alconox wash, tap rinse, HNO₃ spray, DI rinse, acetone spray, air dry and DI rinse.

LEVEL D/MODIFIED LEVEL D DECONTAMINATION PLAN

Check indicated functions or add steps as necessary:

Function	Description of Process, Solution, and Container
<input checked="" type="checkbox"/> Segregated equipment drop	Wipe off with damp towel
<input checked="" type="checkbox"/> Boot cover and glove wash	Alconox and tap water
<input checked="" type="checkbox"/> Boot cover and glove rinse	Tap water
<input checked="" type="checkbox"/> Tape removal - outer glove and boot	Bag
<input checked="" type="checkbox"/> Boot cover removal	Bag
<input checked="" type="checkbox"/> Outer glove removal	Bag
HOTLINE	
<input checked="" type="checkbox"/> Suit/safety boot wash	Alconox and tap water
<input checked="" type="checkbox"/> Suit/boot/glove rinse	Tap water
<input checked="" type="checkbox"/> Safety boot removal	Bag
<input checked="" type="checkbox"/> Suit removal	Bag
<input checked="" type="checkbox"/> Inner glove wash	Alconox and tap water
<input checked="" type="checkbox"/> Inner glove rinse	Tap water
<input checked="" type="checkbox"/> Inner glove removal	Bag
<input type="checkbox"/> Inner clothing removal	
CRC/SAFE ZONE BOUNDARY	
<input checked="" type="checkbox"/> Field wash	Soap and water
<input type="checkbox"/> Redress	
Disposal Plan, End of Day: Bag all PPE.	
Disposal Plan, End of Week: Put into labeled drums and store on site.	
Disposal Plan, End of Project: Dispose of drums off site at the end of the project.	

LEVEL C DECONTAMINATION PLAN

Check indicated functions or add steps as necessary:

Function	Description of Process, Solution, and Container
<input checked="" type="checkbox"/> 1 Segregated equipment drop	Wipe off with damp towel
<input checked="" type="checkbox"/> 2 Boot cover and glove wash	Alconox and tap water
<input checked="" type="checkbox"/> 3 Boot cover and glove rinse	Tap water
<input checked="" type="checkbox"/> 4 Tape removal - outer glove and boot	Bag
<input checked="" type="checkbox"/> 5 Boot cover removal	Bag
<input checked="" type="checkbox"/> 6 Outer glove removal	Bag
HOTLINE	
<input checked="" type="checkbox"/> 7 Suit/safety boot wash	Alconox and tap water
<input checked="" type="checkbox"/> 8 Suit/boot/glove rinse	Tap water
<input checked="" type="checkbox"/> 9 Safety boot removal	Bag
<input checked="" type="checkbox"/> 10 Suit removal	Bag
<input checked="" type="checkbox"/> 11 Inner glove wash	Alconox and tap water
<input checked="" type="checkbox"/> 12 Inner glove rinse	Tap water
<input checked="" type="checkbox"/> 13 Face piece removal	Clean and put in bag
<input checked="" type="checkbox"/> 14 Inner glove removal	Bag
<input type="checkbox"/> Inner clothing removal	
CRC/SAFE ZONE BOUNDARY	
<input checked="" type="checkbox"/> 15 Field wash	Soap and water
<input type="checkbox"/> Redress	
Disposal Plan, End of Day: Bag all PPE.	
Disposal Plan, End of Week: Put into labeled drums and store on site.	
Disposal Plan, End of Project: Dispose of drums off site at the end of the project.	

SITE PERSONNEL AND CERTIFICATION STATUS

WESTON

Name: Bob Burns
Title: Geologist
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Harold Hornung
Title: Project Scientist
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Martin O'Neill, CIH
Title: Project Director
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Gerry Ross
Title: Engineer
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Chris Agnew
Title: Project Scientist
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Laura Amend-Babcock
Title: Engineer
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Jamie Tittensor
Title: Engineer
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Kevin Hansen
Title: Geologist
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name: Gretchen Chapman
Title: Engineer
Task(s): All
Certification Level or Description:

☒ Medical Current

☒ Training Current

☒ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name:
Title:
Task(s):
Certification Level or Description:

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

MEDICAL CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910.29, CFR 1926/1910 or 20 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing: All persons, including visitors, entering any area requiring the use or potential use of any negative pressure respirator must have had as a minimum, a qualitative fit test, administered in accordance with OSHA 20 CFR 1910.134 or ANSI within the last 12 months. If site conditions require the use of a full face negative pressure, air purifying respirator for protection from Asbestos or Lead, employees must have had a quantitative fit test, administered according to OSHA 20 CFR 1910.1002 or 1025 within the last 6 months.

TRAINING CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work, and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 20 CFR 1926/1910 or 29 CFR 1910.120.

The Site Health and Safety Coordinator is responsible for verifying all certifications and fit tests.

SITE PERSONNEL AND CERTIFICATION STATUS

Subcontractor's Health and Safety Program Evaluation

Name of Subcontractor:

Address:

Activities to Be Conducted by Subcontractor:

Evaluation Criteria

Medical program meets OSHA/WESTON criteria

- ☐ Acceptable
☐ Unacceptable

Comments:

Personal protective equipment available

- ☐ Acceptable
☐ Unacceptable

Comments:

Onsite monitoring equipment available, calibrated and operated properly

- ☐ Acceptable
☐ Unacceptable

Comments:

Safe working procedures clearly specified

- ☐ Acceptable
☐ Unacceptable

Comments:

Training meets OSHA/WESTON criteria

- ☐ Acceptable
☐ Unacceptable

Comments:

Emergency procedures

- ☐ Acceptable
☐ Unacceptable

Comments:

Decontamination procedures

- ☐ Acceptable
☐ Unacceptable

Comments:

General health and safety program evaluation

- ☐ Acceptable
☐ Unacceptable

Comments:

Additional comments:

- ☐ Subcontractor has agreed to and will conform with the WESTON HASP for this Project.

- ☐ Subcontractor will work under his own HASP which has been accepted by Corporate Health and Safety.

Evaluation Conducted by:

Date:

Subcontractor

Name:

Title:

Task(s):

Certification Level or Description:

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name:

Title:

Task(s):

Certification Level or Description:

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name:

Title:

Task(s):

Certification Level or Description:

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

Name:

Title:

Task(s):

Certification Level or Description:

☐ Medical Current

☐ Training Current

☐ Fit Test Current (Qual.)

☐ Fit Test Current (Quant.)

TRAINING AND BRIEFING TOPICS

The following items will be covered at the site specific training meeting, daily or periodically.

<input checked="" type="checkbox"/> Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 i	<input type="checkbox"/> Level A
<input checked="" type="checkbox"/> Physical hazards, Table 3.2	<input type="checkbox"/> Level B
<input checked="" type="checkbox"/> Chemical hazards, Table 3.1	<input checked="" type="checkbox"/> Level C
<input checked="" type="checkbox"/> Animal bites, stings, and poisonous plants	<input checked="" type="checkbox"/> Level D
<input type="checkbox"/> Etiologic (infectious) agents	<input checked="" type="checkbox"/> Monitoring, Sec. 7.0; 29 CFR 1910.120 h
<input checked="" type="checkbox"/> Site control, Sec. 8.0; 29 CFR 1910.120 d	<input checked="" type="checkbox"/> Decontamination, Sec. 9.0; 29 CFR 1910.120 k
<input checked="" type="checkbox"/> Engineering controls and work practices, Sec. 8.5; 25 CFR 1910.120 g	<input checked="" type="checkbox"/> Emergency response, Sec. 10.0; 29 CFR 1910.120 l
<input checked="" type="checkbox"/> Heavy machinery	<input checked="" type="checkbox"/> Elements of an emergency response, Sec. 100; 29 CFR 1910.120 l
<input type="checkbox"/> Forklift	<input checked="" type="checkbox"/> Procedures for handling site emergency incidents, Sec. 10.0; 29 CFR 1910.120 l
<input checked="" type="checkbox"/> Backhoe	<input checked="" type="checkbox"/> Offsite emergency response, 29 CFR 1910.120 l
<input checked="" type="checkbox"/> Equipment	<input checked="" type="checkbox"/> Handling drums and containers, 29 CFR 1910.120 j
<input checked="" type="checkbox"/> Tools	<input checked="" type="checkbox"/> Opening drums and containers
<input type="checkbox"/> Ladder 29 CFR 1910.27 d	<input type="checkbox"/> Electrical material handling equipment
<input checked="" type="checkbox"/> Overhead and underground utilities	<input type="checkbox"/> Radioactive waste
<input type="checkbox"/> Scaffolds	<input type="checkbox"/> Shock sensitive waste
<input type="checkbox"/> Structural integrity	<input type="checkbox"/> Laboratory waste packs
<input type="checkbox"/> Unguarded openings - wall, floor, ceilings	<input type="checkbox"/> Sampling drums and containers
<input type="checkbox"/> Pressurized air cylinders	<input checked="" type="checkbox"/> Shipping and transport, 49 CFR 172.101
<input checked="" type="checkbox"/> Personnel protective equipment, Sec. 5.0; 25 CFR 1910.120 g; 29 CFR 1910.134	<input type="checkbox"/> Tank and vault procedures
<input checked="" type="checkbox"/> Respiratory protection, Sec. 5.8; 29 CFR 1910.120 g; Z88.2-1980	<input type="checkbox"/> Illumination, 29 CFR 1910.120 m
	<input type="checkbox"/> Sanitation, 29 CFR 1910.120 n

ATTACHMENT "A"

CHEMICAL CONTAMINANTS

DATA SHEETS

*(Use HASP Form 33HASP.394
or attach appropriate data sheets.)*

=====

CHEMICAL: ANTIMONY COMPOUND

CAS #: NOAA #: 2494

UN #: 1549 STCC: RTECS:

FORMULA: LABEL:

NFPA CODES: H F R S

CERCLA (Y/N): Y EHS (Y/N): 313 (Y/N): Y RCRA:
RQ: 0 TPQ:

LAST UPDATE:12/07/90

STATE at ambient temperature: [Gas, Liquid, Solid] (G/L/S):

LEVEL OF CONCERN: 0.00000000 gm/m3

LIQUID AMBIENT FACTOR:

LIQUID BOILING FACTOR:

LIQUID MOLTEN FACTOR:

SYNONYMS

ANTIMONY COMPOUND
ANTIMONY COMPOUNDS

CAMEO Response Information

[NOAA, 7600 Sand Point Way NE, Seattle, WA 98115 (206) 526-6317]

GENERAL DESCRIPTION:

FIRE & EXPLOSIVE HAZARD:

Some of these materials may burn, but none of them ignites readily.
Flammable/poisonous gases may accumulate in tanks and hopper cars.
Some of these materials may ignite combustibles (wood, paper, oil,
etc.). (DOT,1990)KEI

FIRE FIGHTING:

Some of these materials may react violently with water. SMALL FIRES: Dry chemical, CO2, water spray or regular foam. LARGE FIRES: Water spray, fog or regular foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. (DOT,1990)NI

PROTECTIVE CLOTHING AND SUIT MATERIAL COMPATIBILITY (ACGIH 1985:)

NONFIRE RESPONSE:

Do not touch or walk through spilled material; stop leak if you can do it without risk. SMALL SPILLS: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. SMALL DRY SPILLS: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area. LARGE SPILLS: Dike far ahead of liquid spill for later disposal. (DOT,1990)#:I

HEALTH HAZARDS:

Contact causes burns to skin and eyes. If inhaled, may be harmful. Fire may produce irritating or poisonous gases. Runoff from fire control or dilution water may cause pollution. (DOT,1990) I

FIRST AID:

If this chemical comes in contact with the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates through the clothing, immediately remove the clothing, wash the skin with soap and water, get medical attention promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible. If this chemical has been swallowed, get medical attention immediately. (NIOSH, 1987)Y

CHEMICAL PROPERTIES:

IDLH: 80 mg/m3 For Antimony. (NIOSH, 1987)

TLV TWA: 0.5 mg/m3 For Antimony. ((C)ACGIH, 1990)

INSY

CAMEO Response Information, Version 2.0, June 1987
NOAA, 7600 Sand Point Way NE, Seattle, WA 98115 (206) 526-6317

NAME:
DIOCTYL PHTHALATE

CAS Registry Number: 117840

Label: UN/NA:

NFPA Ratings : Health: 0 Flam: 1 React: 0 Spec:

GENERAL DESCRIPTION:

Liquid. It is used as a plasticizer for plastics; rubber materials; cellulose ester resins; polystyrene resins; and vinyl resins. (EPA, 1986)

FIRE & EXPLOSIVE HAZARD:

When on fire, these materials offer no health hazard beyond that presented by ordinary combustible materials. When heated to decomposition, it emits acrid smoke and fumes. (EPA, 1986)

FIRE FIGHTING:

Water or foam may cause frothing. Water spray carefully applied has been successful in extinguishing fires. Use normal firefighting procedures. (EPA, 1986)

PROTECTIVE CLOTHING:

There may be some need for skin protection. (EPA, 1986)

SUIT MATERIAL COMPATIBILITY (Based on ACGIH, 1985):

BUTYL	
CHLOROBUTYL	
CHLOR RUB	
CPE	
CR 39	
EVA/PE	
FEP OR TFE	
HYPALON	
NBR	
NEOPRENE	Good Resistance/Limited Data.
NEO/RUB	
NEO/SBR	
NITRILE	Good Resistance/Limited Data.
NITRILE/PVC	
PE	
POLYCARB	
PU	
PVA	
PVC	

Codebreaker information on chemicals Matching Search String:

ENTRY: 1
NOAA #: 4970
CHEMICAL NAME:
DIOCTYL PHTHALATE

CAS:
117840
FORMULA: C24H38O4
RTECS: TI0350000
STCC:
UN #:
HAZLAB:
SYNONYM:

1,2-BENZENEDICARBOXYLIC ACID, DIOCTYL ESTER\ DINOPOL NCP\ DIOCTYL
PHTHALATE\ DI-N-OCTYL PHTHALATE\ DIOCTYL O-PHTHALATE\ DNOP\ OCTYL
PHTHALATE\ N-OCTYL PHTHALATE\ PHTHALIC ACID, DIOCTYL ESTER\ PHTHALIC
ACID DIOCTYL ESTER\ VINICIZER 85\ PHTHALIC ACID, BIS(2-ETHYLHEXYL)
ESTER\ BEHP\ 1,2-BENZENEDICARBOXYLIC ACID, BIS(2-ETHYLHEXYL)
ESTER\ BIS(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE\ BIS(2-ETHYLHEXYL)PH
THALATE\ BISO FLEX 81\ BISO FLEX DOP\ COMPOUND 889\ DAF
68\ DEHP\ DI(2-ETHYLHEXYL)ORTHOPHTHALATE\ DI(2-ETHYLHEXYL)PHTHALATE\ DI-
SEC-OCTYL PHTHALATE\ DI-SEC-OCTYL PHTHALATE (ACGIH)\ DOP\ ERGOPLAST
FDO\ ETHYLHEXYL PHTHALATE\ 2-ETHYLHEXYL PHTHALATE\ EVIPLAST 80\ EVIPLAST
81\ FLEXIMEL\ FLEXOL DOP\ FLEXOL PLASTICIZER DOP\ GOOD-RITE GP
264\ HATCOL DOP\ HERCOFLEX 260\ KODAFLEX DOP\ MOLLAN
O\ NCI-C52733\ NUOPLAZ DOP\ OCTOIL\ PALATINOL AH\ PITTSBURGH
PX-138\ PLATINOL AH\ PLATINOL DOP\ RC PLASTICIZER DOP\ RCRA WASTE NUMBER
U028\ REOMOL DOP\ REOMOL D 79P\ SICOL 150\ STAFLEX DOP\ TRUFLEX
DOP\ VESTINOL AH\ VINICIZER 80\ WITCIZER 312

SEV. 5.1
RUB/NEO/NBR
RUB/NEO/SBR
SARANEX
SBR

10-10-80 2:00PM

ROY F. WESTON #12/13

VITON Good Resistance/Limited Data.
VITON/NEO

NONFIRE RESPONSE:

The synthesis of phthalates requires good ventilation in order to prevent contamination of air with phthalic anhydride or alcohols. (EPA, 1986)

HEALTH HAZARDS:

This chemical is rated as slightly to moderately toxic, with a probable oral lethal dose for humans of 0.5-15 g/kg body weight, or between 1 ounce and 1 quart dose for a 70 kg person. This chemical rarely causes skin difficulties and its low vapor pressure precludes the inhalation of any significant amounts. Signs and Symptoms of Exposure: The chemical might cause mucous membrane irritation and central nervous system depression if absorbed. Human dermal patch testing showed no irritation and sensitization. (EPA, 1986)

FIRST AID:

Procedures are those for general poisoning. After oral exposure, establish respiration and prevent absorption. After skin exposure, the skin should be washed thoroughly with soap and water. After eye exposure, eyes should be irrigated with tap water. (EPA, 1986)

FLASH POINT:

426 Deg F unspecified (EPA, 1986)

LOWER EXPLOSIVE LIMIT:

0.3 % (EPA, 1986)

UPPER EXPLOSIVE LIMIT:

Not Applicable. (USCG, 1985)

AUTO IGNITION TEMPERATURE:

MELTING POINT:

-22 Deg F (EPA, 1986)

VAPOR PRESSURE:

0.2 mm Hg @ 302 Deg F (EPA, 1986)

VAPOR DENSITY (AIR = 1):

16 (EPA, 1986)

SPECIFIC GRAVITY-LIQUID (H2O=1):

0.9861 (EPA, 1986)

SPECIFIC GRAVITY-SOLID (H2O=1):

BOILING POINT:

MOLECULAR WEIGHT:
390.62 (EPA, 1986)

IDLH:

TLV - TIME WEIGHTED AVERAGE:

TLV - SHORT TERM EXPOSURE LIMIT:

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855



GENIUM PUBLISHING CORP.

No. 203

LEAD CARBONATE,
BASIC

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: LEAD CARBONATE, BASIC

DESCRIPTION/USES: Found in nature as the mineral hydrocerussite. Used as a pigment in oil paints and water colors; in cements; for making putty and lead carbonate paper; in the processing of parchment.

OTHER DESIGNATIONS: Lead Carbonate Hydroxide, Basic White Lead, Hydrocerussite, $2\text{Pb CO}_3 \cdot \text{Pb(OH)}_2$, CAS #1319-46-6

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
JT Baker Chemical Co., 222 Red School Lane., Phillipsburg, NJ 08865;
Telephone: (201) 859-5411

HMIS

H 3 (Chronic)

F 0

R 0

PPE*

*See Sect. 8

Not Found

R 1

I 4

S 1

K 0

SECTION 2. INGREDIENTS AND HAZARDS

Lead Carbonate, Basic, CAS #1319-46-6

%

>99%

HAZARD DATA

OSHA PEL*

8-hr. TWA: 0.05 mg/m³

OSHA Action Level**

8-hr. TWA: 0.03 mg/m³

ACGIH TLV***

8-hr. TWA: 0.15 mg/m³

Oral, Guinea Pig,
LDLo: 1000 mg/kg

- * Current OSHA PEL, as Pb.
- ** Concentration that triggers certain provisions of the OSHA Lead Standard (29 CFR 1910.1025).
- *** Current (1986-87) ACGIH TLV for inorganic lead, as Pb.

SECTION 3. PHYSICAL DATA

Melting Point ... 752°F (400°C) (Decomposes)

Specific Gravity ... 6.14

Vapor Pressure at 20°C ... Negligible

Vapor Density ... Not Found

Evaporation Rate ... Not Found

Solubility in Water ... Insoluble in Hot and Cold Water

Molecular Weight ... 775.6

Appearance and odor: White, heavy powder. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method

Not Found

Autoignition Temperature

Not Found

Flammability Limits in Air

Not Found

LOWER UPPER

--

--

EXTINGUISHING AGENTS: Basic lead carbonate is not combustible. Use extinguishing agents (dry chemical, CO₂, water spray, or foam) that are suitable for the surrounding fire.

UNUSUAL FIRE/EXPLOSION HAZARDS: Toxic dust, mist, and/or fumes may be generated under fire conditions. Runoff of fire-control water may cause pollution; minimize runoff to sewers and surface water.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Basic lead carbonate is stable at room temperature. It does not polymerize.

This material ignites and burns intensely on contact with fluorine. Carbon dioxide is generated on its contact with acids.

It decomposes at 752°F (400°C) to form lead oxide (PbO) and oxides of carbon (CO₂, CO).

SECTION 6. HEALTH HAZARD INFORMATION

Basic lead carbonate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA. This material can enter the body if it is inhaled or swallowed.

EFFECTS OF OVEREXPOSURE: **ACUTE:** Excessive inhalation of dust may cause irritation of the nose and throat, fatigue, and abdominal pain. Severe acute exposure can lead to chronic effects. On ingestion, symptoms include headache, abdominal pain, nausea, vomiting, and, in severe cases, coma and death. Eye contact can cause redness and pain. The chief effects of excessive lead intake are anemia, neurological disorders, and kidney damage. Symptoms of the neurological effects may include irritability, headaches, insomnia, delirium, convulsions, muscular tremors, and palsy of the extremities. Excessive exposure to lead may also have adverse effects on human reproductive capabilities. **FIRST AID:** Any worker who experiences symptoms of lead poisoning should be removed from exposure and receive prompt medical help.* **EYE CONTACT:** Flush eyes, including under the eyelids, with a gentle flow of running water to remove particulates. Get medical help.* **SKIN CONTACT:** Thoroughly wash affected area with mild soap and water. If irritation develops, get medical help.* **INHALATION:** Remove victim from exposure. Keep him warm and at rest. Get medical help.* **INGESTION:** Immediately give victim a large quantity of water or milk to drink, then induce vomiting. Keep him warm and at rest. Get medical help immediately.* **NOTE:** Never induce vomiting if someone is unconscious or convulsing or give him anything by mouth.

* **GET MEDICAL ASSISTANCE:** In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Before using basic lead carbonate it is essential that proper emergency procedures be established and made known to all involved personnel. Notify safety/environmental personnel of large basic lead carbonate spills. Ventilate spill area. Cleanup personnel should wear respiratory protection, gloves, and protective clothing. Carefully vacuum up spilled material (vacuum cleaner must have filters to prevent dust dispersion). Place collected material in a suitable container that can be tightly sealed. Shovel and dry or wet sweeping should be used only when these methods are more effective than vacuuming. Avoid dusting conditions at all stages of handling. Reclaim material when possible. Unsalvageable waste may require disposal as a hazardous waste in an approved chemical waste landfill. Contact your supplier or a licensed chemical waste disposal contractor for disposal instruction. Follow Federal, state, and local regulations.

Reportable Spill Quantity: None given in 40 CFR 117.3, Table 117.3, "Reportable Quantities of Hazardous Substances."
EPA Hazardous Waste Number: D008 (EP Toxic, 40 CFR 261.24)

SECTION 8. SPECIAL PROTECTION INFORMATION

Use local exhaust ventilation that is sufficient to maintain airborne dust levels below the OSHA PEL.
Use NIOSH-approved respirators where engineering control and work practices do not reduce exposures to or below the PEL. Respirators should have protection factors suitable for the level of exposure. Half-mask air-purifying respirators with high-efficiency filters are acceptable for concentrations of up to 0.5 mg/m³. Use a full-facepiece respirator with concentrations of up to 2.5 mg/m³. Use respirators in accordance with OSHA requirements (29 CFR 1910.134 and 1910.1025).
Wear dust-proof safety goggles when handling this material. Wear protective clothing and equipment such as coveralls, gloves, hats, and shoes when exposure exceeds the PEL or where the possibility of contact with skin and eyes exists. Provide clean body-covering work clothing weekly to workers who are exposed to concentrations above the PEL (do this daily if exposure is above 0.2 mg/m³) and arrange for special handling and laundering of contaminated clothing.
Changing rooms (with separate storage facilities for street and work clothing) and showers are required for employees exposed to concentrations above the PEL. Prevent dust from being transported to the lunchroom through the ventilation system or on contaminated clothing. Consult the OSHA Lead Standard (29 CFR 1910.1025) for detailed requirements.
Eyewash stations and washing facilities should be readily accessible.
Contact lenses pose a special hazard: soft lenses may absorb irritants and all lenses concentrate them. Particles can adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store basic lead carbonate in tightly closed containers in a cool, dry location. Protect containers from physical damage. Keep this material away from food and food products.

Use good housekeeping procedures to prevent accumulation of dust. Do not use compressed air for cleansing surfaces or clothing; use a vacuum cleaner with appropriate filters. Practice good personal hygiene: wash face and hands thoroughly before eating, drinking, and smoking. Do not eat, drink, or use tobacco in areas of use. Remove contaminated clothing promptly. Launder it before wearing it again. Do not take this material out of your work area or to your home on your clothing or equipment. Exposure monitoring, biological monitoring, and medical surveillance should be provided in accordance with the OSHA Lead Standard (29 CFR 1910.1025) where applicable. Prevent generation of dust. Use this material where there is adequate ventilation. Avoid inhalation and skin/eye contact. Do not eat basic lead carbonate.

DOT Hazard Classification: Lead Carbonate is not listed in the DOT Hazardous Materials Tables (49 CFR 172.101 or 102)
Data Source(s) Code: 2, 4, 5, 9, 12, 14, 20, 25, 44, 57, 58, 61, 62, 80, 82, 84, CV

Judgements as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of such information, Gosselin Publishing Corp. extends no warranties, makes no representations and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Approvals

Indust. Hygiene/Safety

Medical Review

Copyright © January 1, 1987

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

1 -PRODUCT IDENTIFICATION

PRODUCT NAME: METHYLENE CHLORIDE
COMMON SYNONYMS: DICHLOROMETHANE; METHYLENE DICHLORIDE; METHANE DICHLORIDE
CHEMICAL FAMILY: CHLORINATED HYDROCARBONS
FORMULA: CH₂CL₂
FORMULA WT.: 84.93
CAS NO.: 75-09-2
NIOSH/RTECS NO.: PA8050000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 5378,9330,9348,9324,Q480,9315,9313,9329,9341,9128,5531,9264

NOTE: A Standard Phrase was referenced here but was not found.
The filename referenced was JTADDR.STD
Call your SAF-T-MANAGER Administrator for help

EFFECTIVE: 04/28/92 ISSUED: 09/30/92
REVISION #07

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	3	SEVERE (CANCER CAUSING)
FLAMMABILITY	-	1	SLIGHT
REACTIVITY	-	1	SLIGHT
CONTACT	-	2	MODERATE

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

WARNING

MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE. EXCEPTIONAL CONTACT HAZARD: READ MATERIAL SAFETY DATA SHEET.

KEEP AWAY FROM HEAT, MOISTURE, AND DIRECT SUNLIGHT. AVOID CONTACT WITH EYES, SKIN, CLOTHING. DO NOT BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL, SOAK UP WITH SAND OR EARTH.

PRECAUTIONARY LABELING (CONTINUED)

INTERNATIONAL LABELING

HARMFUL BY INHALATION. POSSIBLE RISKS OF IRREVERSIBLE EFFECTS.
AVOID CONTACT WITH SKIN.

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

1 -PRODUCT IDENTIFICATION (continued)

SAF-T-DATA* STORAGE COLOR CODE: BLUE (HEALTH)

2 -COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
METHYLENE CHLORIDE	75-09-2	98-100	500 PPM	50 PPM

3 -PHYSICAL DATA

BOILING POINT: 40 C (104 F) (AT 760 MM HG)	VAPOR PRESSURE (MMHG): 350 (20 C)
---	--------------------------------------

MELTING POINT: -95 C (-139 F) (AT 760 MM HG)	VAPOR DENSITY (AIR=1): 2.9
---	----------------------------

SPECIFIC GRAVITY: 1.32 (H2O=1)	EVAPORATION RATE: 27.5 (BUTYL ACETATE = 1)
-----------------------------------	---

SOLUBILITY(H2O): MODERATE (1-10%)	% VOLATILES BY VOLUME: 100 (21 C)
-----------------------------------	--------------------------------------

PH: N/A

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. ETHER-LIKE ODOR.

4 -FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): N/A

NFPA 704M RATING: 2-1-0

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - 19 % LOWER - 12 %

FIRE EXTINGUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED

BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

4 -FIRE AND EXPLOSION HAZARD DATA (continued)

MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

CONCENTRATED VAPOR CAN BE IGNITED BY A HIGH INTENSITY IGNITION SOURCE. VAPOR MAY FORM FLAMMABLE MIXTURE IN ATMOSPHERE THAT CONTAINS A HIGH PERCENTAGE OF OXYGEN. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE.

TOXIC GASES PRODUCED

HYDROGEN CHLORIDE, PHOSGENE, CHLORINE, CARBON MONOXIDE, CARBON DIOXIDE

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT

NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE

NONE IDENTIFIED.

5 -HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 174 MG/M3 (50 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): (500 PPM)

PEL (CEILING) = 1000 PPM.

TOXICITY OF COMPONENTS

ORAL RAT LD50 FOR METHYLENE CHLORIDE	2136 MG/KG
INTRAPERITONEAL MOUSE LD50 FOR METHYLENE CHLORIDE	437 MG/KG
SUBCUTANEOUS MOUSE LD50 FOR METHYLENE CHLORIDE	6460 MG/KG
INHALATION-30MIN RAT LC50 FOR METHYLENE CHLORIDE	88 G/M3
CARCINOGENICITY: NTP: NO IARC: YES Z LIST: NO OSHA REG: NO	

CARCINOGENICITY

THIS SUBSTANCE IS LISTED AS AN IARC PROBABLE HUMAN CARCINOGEN (GROUPS 2A AND 2B).

REPRODUCTIVE EFFECTS

TESTS ON LABORATORY ANIMALS INDICATE MATERIAL MAY BE MUTAGENIC.

EFFECTS OF OVEREXPOSURE

INHALATION: HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, WEAKNESS, FATIGUE, IRRITATION OF UPPER RESPIRATORY TRACT, CENTRAL NERVOUS SYSTEM DEPRESSION, CAUSES METHEMOGLOBULIN

FORMATION IN THE BLOOD, PULMONARY EDEMA, UNCONSCIOUSNESS,

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

5 -HEALTH HAZARD DATA (continued)

AND MAY BE FATAL.

SKIN CONTACT: IRRITATION, MAY BE HARMFUL, PROLONGED CONTACT MAY CAUSE DERMATITIS

EYE CONTACT: IRRITATION, MAY CAUSE TEMPORARY CORNEAL DAMAGE

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, WEAKNESS, FATIGUE, GASTROINTESTINAL IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESSION, CAUSES METHEMOGLOBULIN FORMATION IN THE BLOOD, UNCONSCIOUSNESS, AND MAY BE FATAL.

CHRONIC EFFECTS: DAMAGE TO LIVER, KIDNEYS, LUNGS, BLOOD, CENTRAL NERVOUS SYSTEM

TARGET ORGANS

RESPIRATORY SYSTEM, LUNGS, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, EYES, SKIN

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

CARDIOVASCULAR DISORDERS, HEART DISORDERS, LIVER OR KIDNEY DISORDERS, CENTRAL NERVOUS SYSTEM DISORDERS, HEAVY DRINKERS, HEAVY SMOKERS

PRIMARY ROUTES OF ENTRY

INHALATION, INGESTION, SKIN CONTACT, EYE CONTACT, ABSORPTION

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: NO PRESSURE: NO REACTIVITY: NO

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

5 -HEALTH HAZARD DATA (continued)

EXTREMELY HAZARDOUS SUBSTANCE: NO

CERCLA HAZARDOUS SUBSTANCE: YES

SARA 313 TOXIC CHEMICALS: YES

CONTAINS 2-BUTANONE (RQ = 5000 LBS)

CONTAINS DICHLOROMETHANE (METHYLENE
CHLORIDE)

GENERIC CLASS:

GENERIC CLASS REMOVED FROM CFR: 7/1/91

TSCA INVENTORY:

YES

STATE LISTS: FOR PRODUCTS SOLD IN THE STATE OF CALIFORNIA, THE STATE REQUIRES
THAT WE PROVIDE TO USERS AND THEIR EMPLOYEES THE FOLLOWING MESSAGE: WARNING:
THIS PRODUCT IS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

6 -REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID:

HEAT, FLAME, OTHER SOURCES OF IGNITION, MOISTURE,
LIGHT

INCOMPATIBLES:

ALKALI METALS, STRONG OXIDIZING AGENTS, STRONG BASES,
OXIDES OF NITROGEN, ZINC, ALUMINUM, WATER, MAGNESIUM,
AMINES, PLASTICS, RUBBER, SODIUM, POTASSIUM

DECOMPOSITION PRODUCTS:

HYDROGEN CHLORIDE, PHOSGENE, CHLORINE, CARBON
MONOXIDE, CARBON DIOXIDE

7 -SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP
LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS.
TAKE UP WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE
INTO CONTAINER FOR LATER DISPOSAL. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER:

U080 (TOXIC WASTE)

8 -INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION:

USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV
REQUIREMENTS.

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

8 -INDUSTRIAL PROTECTIVE EQUIPMENT (continued)

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS ABOVE 100 PPM, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

9 -STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* STORAGE COLOR CODE: BLUE (HEALTH)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN SECURE POISON AREA. KEEP CONTAINERS OUT OF SUN AND AWAY FROM HEAT.

SPECIAL PRECAUTIONS

MATERIAL IS HYGROSCOPIC.

10 -TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: DICHLOROMETHANE (AIR ONLY)

HAZARD CLASS: ORM-A

UN/NA: UN1593 REPORTABLE QUANTITY: 1000 LBS. PACKAGING GROUP: III

REGULATORY REFERENCES: 49CFR 172.101

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: DICHLOROMETHANE

HAZARD CLASS: 6.1

UN: UN1593 MARINE POLLUTANTS: NO

LABELS: HARMFUL - STOW AWAY FROM FOOD STUFFS

REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMO

I.M.O. PAGE: 6127

PACKAGING GROUP: III

AIR (I.C.A.O.)

PROPER SHIPPING NAME: DICHLOROMETHANE

HAZARD CLASS: 6.1

UN: UN1593

PACKAGING GROUP: III

LABELS: KEEP AWAY FROM FOOD

REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA== WE BELIEVE THE TRANSPORTATION DATA AND REFERENCES CONTAINED HEREIN

TO BE FACTUAL AND THE OPINION OF QUALIFIED EXPERTS. TH

J.T.BAKER MSDS
MSDS for METHYLENE CHLORIDE

10 -TRANSPORTATION DATA AND ADDITIONAL INFORMATION (continued)

DATA IS MEANT AS A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.=== THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL

LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR 172.3 AND EMPLOYEE TRAINING 49CFR 173.1.

U.S. CUSTOMS HARMONIZATION NUMBER: 29031200000

EPA/TSCA EXPORT NOTIFICATION
YES

N/A = NOT APPLICABLE OR NOT AVAILABLE
N/E = NOT ESTABLISHED

NOTE: A Standard Phrase was referenced here but was not found.
The filename referenced was JTDSCLMR.STD
Call your SAF-T-MANAGER Administrator for help

CHEMICAL: POLYCHLORINATED BIPHENYLS

CAS #: 1336-36-3

NOAA #: 4286

UN #: 2315

STCC: 4961666

RTECS: TQ1350000

FORMULA:

LABEL: NONE

NFPA CODES: H F R S

CERCLA (Y/N): Y
RQ: 1EHS (Y/N):
TPQ:

313 (Y/N): Y RCRA:

LAST UPDATE: 12/08/90

STATE at ambient temperature: [Gas, Liquid, Solid] (G/L/S):

LEVEL OF CONCERN: 0.00000000 gm/m3

LIQUID AMBIENT FACTOR:

LIQUID BOILING FACTOR:

LIQUID MOLTEN FACTOR:

CAMEO Response Information

[NOAA, 7600 Sand Point Way NE, Seattle, WA 98115 (206) 526-6317]

GENERAL DESCRIPTION:

Polychlorinate biphenyls are colorless to light colored liquids. They are used as coolants in transformers and in electrical capacitors. They are insoluble in water. They are non-volatile and non-combustible. They are extremely persistent in the environment. It weighs 12.5 lbs/gallon. ((C)AAR, 1990) #

FIRE & EXPLOSIVE HAZARD:

Combustible. Irritating gases are generated in fires. (USCG, 1989) w@

FIRE FIGHTING:

Extinguish fire using agent suitable for type of surrounding fire (material itself does not burn or burns with difficulty). ((C)AAR, 1990) A C

PROTECTIVE CLOTHING AND SUIT MATERIAL COMPATIBILITY (ACGIN 1985:)

Butyl Rubber: Poor Resistance / Limited Data
Chlorinated Polyethylene (CPE): Poor Resistance / Limited Data
Natural Rubber: Poor Resistance / Good Data
Neoprene: Good Resistance / Limited Data
Polyethylene (PE): Poor Resistance / Good Data
Polyvinyl Alcohol: Good Resistance / Limited Data
Polyvinyl Chloride (PVC): Poor Resistance / Limited Data
Viton: Good Resistance / Limited Data
EFLON: Good Resistance / Limited Data
SARANEX: Good Resistance / Good Data
(A.D. Little, 1987)RC

NONFIRE RESPONSE:

Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Absorb bulk liquid with fly ash or cement powder. Water spill: Use natural deep water pockets, excavated lagoons, or sand bag barriers to trap material at bottom. If dissolved, in region of 10 ppm or greater concentration, apply activated carbon at ten times the spilled amount. Remove trapped material with suction hoses. Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates. ((C)AAR, 1990)INI

HEALTH HAZARDS:

LIQUID OR SOLID: Irritating to skin and eyes. (USCG, 1989)

FIRST AID:

If this chemical comes in contact with the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical. If this chemical comes in contact with the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates through the clothing, immediately remove the clothing, wash the skin with soap and water, get medical attention promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible. If this chemical has been swallowed, get medical attention immediately. (NIOSH, 1987)

CHEMICAL PROPERTIES:

Flash Point: >286 Deg. F (unspc) (USCG, 1989)
Boiling Point: Not Applicable. (USCG, 1989)
Vapor Pressure: Not Applicable. (USCG, 1989)
Vapor Density (air = 1): Not Applicable. (USCG, 1989)
Specific Gravity, Liquid: 1.3 to 1.8 at 68 Deg. F (USCG, 1989)
Melting Point: Very high. (USCG, 1989)

DATE:05/26/93

CAMEO CHEMICAL REPORT

PAGE: 3

Molecular Weight: 326 (NIOSH, 1987)

IDLH: Not applicable, potential human carcinogen. (NIOSH, 1987)

TLV TWA: 0.5 mg/m3 For chlorodiphenyl (54% Chlorine). Skin.

((C)ACGIH, 1990)

TLV STEL: 1 mg/m3 For chlorodiphenyl (54% Chlorine). Skin.

((C)ACGIH, 1990)CTA

DATE:02/10/94

CAMEO CHEMICAL REPORT

PAGE: 1

CHEMICAL: XYLENE

CAS #: 1330-20-7

NOAA #: 8151

UN #: 1307

STCC: 4909350

RTECS: ZE2100000

FORMULA: C8H10

LABEL: FLAMMABLE LIQUID

NFPA CODES: H2 F3 RO S

CERCLA (Y/N): Y

EHS (Y/N):

313 (Y/N): Y

RCRA: U239

RQ: 1000

TPQ:

LAST UPDATE:12/08/90

STATE at ambient temperature: [Gas, Liquid, Solid] (G/L/S):

LEVEL OF CONCERN: 0.00000000 gm/m3

LIQUID AMBIENT FACTOR:

LIQUID BOILING FACTOR:

LIQUID MOLTEN FACTOR:

SYNONYMS

BENZENE, DIMETHYL-

DILAN

DIMETHYLBENZENE

DIMETHYLBENZENE (OSHA)

KSYLEN (POLISH)

METHYL TOLUENE

NCI-C55232

RCRA WASTE NUMBER U239

VIOLET 3

XILOLI (ITALIAN)

XYLENE

XYLENE (ACGIH, DOT, OSHA)

XYLENE (MIXED ISOMERS)

XYLENEN (DUTCH)

XYLOL

XYLOL (DOT)

XYLOLE (GERMAN)

CAMEO Response Information

[NOAA, 7600 Sand Point Way NE, Seattle, WA 98115 (206) 526-6317]

GENERAL DESCRIPTION:

Xylene is a clear colorless liquid with a characteristic aromatic odor. It is used as a solvent for paints and adhesives, and to make other chemicals. It has a flash point of 81-90 deg. F. It is lighter than water and insoluble in water. Its vapors are heavier than air. It weighs 7.2 pounds per gallon. ((C)AAR, 1990)EI

FIRE & EXPLOSIVE HAZARD:

Flammable/combustible material; may be ignited by heat, sparks or flames. Vapors may travel to a source of ignition and flash back. Container may explode in heat of fire. Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. (DOT,1990)INI

FIRE FIGHTING:

Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may spread fire. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide. ((C)AAR, 1990)IN

PROTECTIVE CLOTHING AND SUIT MATERIAL COMPATIBILITY (ACGIN 1985:)

Butyl Rubber: Poor Resistance / Limited Data
Chlorinated Polyethylene (CPE): Poor Resistance / Limited Data
Viton/Neoprene: Good Resistance / Limited Data
Natural Rubber: Poor Resistance / Good Data
Neoprene: Poor Resistance / Good Data
Nitrile + Polyvinyl Chloride: Poor Resistance / Good Data
Nitrile: Poor Resistance / Good Data
Polyethylene (PE): Poor Resistance / Good Data
Polyvinyl Alcohol: Good Resistance / Good Data
Polyvinyl Chloride (PVC): Poor Resistance / Good Data
Viton: Good Resistance / Limited Data
Butyl Rubber/Neoprene: Poor Resistance / Limited Data
TEFLON: Good Resistance / Limited Data
Neoprene/Natural Rubber: Poor Resistance / Good Data
Nat Rub/Neoprene/NBR: Poor Resistance / Good Data
Styrene-Butadiene Rubber (SBR): Poor Resistance / Limited Data
Neoprene + Natural Rubber: Poor Resistance / Good Data
(A.D. Little, 1987)

NONFIRE RESPONSE:

Keep sparks, flames, and other sources of ignition away. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel hazard. Use water spray to knock-down vapors. Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed

concrete. Absorb bulk liquid with fly ash, cement powder, or commercial sorbents. Apply "universal" gelling agent to immobilize spill. Apply appropriate foam to diminish vapor and fire hazard.

Water spill: Use natural barriers or oil spill control booms to limit spill travel. Use surface active agent (e.g. detergent, soaps, alcohols), if approved by EPA. Inject "universal" gelling agent to solidify encircled spill and increase effectiveness of booms. If dissolved, in region of 10 ppm or greater concentration, apply activated carbon at ten times the spilled amount. Remove trapped material with suction hoses. Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates. ((C)AAR, 1990)

HEALTH HAZARDS:

May be poisonous if inhaled or absorbed through skin. Vapors may cause dizziness or suffocation. Contact may irritate or burn skin and eyes. Fire may produce irritating or poisonous gases. Runoff from fire control or dilution water may cause pollution. (DOT,1990)

FIRST AID:

If this chemical comes in contact with the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical. If this chemical comes in contact with the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates through the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible. If this chemical has been swallowed, get medical attention immediately. (NIOSH, 1987) p

CHEMICAL PROPERTIES:

Flash Point: 81 to 90 Deg. F (cc) For mixture of isomers. (NIOSH, 1987)

Lower Exp Limit: 1 to 1.1 % For mixture of isomers. (NIOSH, 1987)

Melting Point: -54 to 55 Deg. F For mixture of isomers. (NIOSH, 1987)

Vapor Pressure: 7 to 9 mm at 68 Deg. F (NIOSH, 1987)

Specific Gravity, Liquid: 0.86 ((C)AAR, 1990)

Boiling Point: 281 to 292 Deg. F at 760 mm (NIOSH, 1987)

Molecular Weight: 106 (NIOSH, 1987)

IDLH: 10000 ppm For O, M, and P isomers. (NIOSH, 1987)

TLV TWA: 100 ppm ((C)ACGIH, 1990)

TLV STEL: 150 ppm ((C)ACGIH, 1990)ill

Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties		Incompatibilities and reactivities	Measurem/ method (See Table
					MW, BP, SOL F.P., IP, Sp.Gr, flammability	VP, FRZ UEL, LEL		
Ethyl acrylate <chem>CH2=CHCOOC2H5</chem> 140-88-5 AT0700000	Ethyl acrylate (inhibited), Ethyl ester of acrylic acid, Ethyl propenoate	NIOSH Ca See Appendix A OSHA 5 ppm (20 mg/m³) ST 25 ppm (100 mg/m³) [skin]	Ca [2000 ppm]	Colorless liquid with an acid odor.	MW: 100.1 BP: 211°F Sol: 2% F.P.: 46°F IP: ?	VP: 29 mm FRZ: -96°F UEL: 14% LEL: 1.4%	Oxidizers, peroxides, polymerizers, strong alkalis, moisture, chlorosulfonic acid [Note: Polymerizes readily unless an inhibitor such as hydroquinone is added.]	Char: CS; GC/FID: III [#1450, Esters]
1917 27	1 ppm = 4.16 mg/m³				Sp.Gr: 0.92 Class IB Flammable Liquid			
Ethylamine <chem>CH3CH2NH2</chem> 75-04-7 KH2100000	Aminoethane, Ethylamine (anhydrous), Monoethylamine	NIOSH/OSHA 10 ppm (18 mg/m³)	4000 ppm	Colorless gas or water-white liquid (below 62°F) with an ammonia-like odor. [Note: Shipped as a liquefied compressed gas.]	MW: 45.1 BP: 62°F Sol: Miscible F.P.: 1°F IP: 8.66 eV	VP: >1 atm FRZ: -114°F UEL: 14.0% LEL: 3.5%	Strong acids; strong oxidizers; copper, tin & zinc in presence of moisture; cellulose nitrate	Si gel: H₂SO₄; GC/FID: II(3) [#144]
1036 68	1 ppm = 1.87 mg/m³				Sp.Gr: 0.69 (Liquid) Flammable Gas Class IA Flammable Liquid			
Ethyl benzene <chem>CH3CH2C6H5</chem> 100-41-4 DA0700000	Ethylbenzol, Phenylethane	NIOSH/OSHA 100 ppm (435 mg/m³) ST 125 ppm (545 mg/m³)	2000 ppm	Colorless liquid with an aromatic odor.	MW: 106.2 BP: 277°F Sol: 0.01% F.P.: 55°F IP: 8.76 eV	VP(79°F): 10 mm FRZ: -139°F UEL: 8.7% LEL: 1.0%	Strong oxidizers	Char: CS; GC/FID: II [#1501, Aromatic Hydro- carbons]
1175 26	1 ppm = 4.41 mg/m³				Sp.Gr: 0.87 Class IB Flammable Liquid			

Personal protection
and sanitation
(See Table 3)

Recommendations
for respirator
selection — maximum
concentration for use (MUC)
(See Table 4)

Health hazards

Route

Symptoms
(See Table 5)

First aid
(See Table 6)

Target organs
(See Table 5)

Clothing: Repeat Goggles: Reason prob Wash: Prompt wet Change: N.R. Remove: Immed wet (flamm)	NIOSH V: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Irrit eyes, resp sys, skin; (carc)	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Resp support Medical attention immed	Resp sys, eyes, skin
Clothing: Reason prob Goggles: Any poss Wash: Immed contam Change: N.R. Remove: Immed wet/Immed non-imperv contam Provide: Eyewash, quick drench	NIOSH/OSHA 250 ppm: SA:CF/PAPRS ^c 500 ppm: CCRFS/GMFS/SCBAF/SAF 4000 ppm: SAF:PD,PP g: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFS/SCBAE	Inh Abs Ing Con	Irrit eyes; burns skin; resp irrit; derm	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Resp support Medical attention immed	Resp sys, eyes, skin
Clothing: Repeat Goggles: Reason prob Wash: Prompt contam Change: N.R. Remove: Immed wet (flamm)	NIOSH/OSHA 1000 ppm: PAPROV*/SA*/SCBA*/ CCROV* 2000 ppm: GMFOV/SCBAF/SAF g: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Irrit eyes, muc memb; head; derm; narco, coma	Eye: Skin: Breath: Swallow:	Irr immed Water flush prompt Resp support Medical attention immed	Eyes, upper resp sys, skin, CNS
Clothing: Repeat Goggles: Reason prob Wash: Prompt wet Change: N.R. Remove: Immed wet (flamm)	OSHA 2000 ppm: SA/SCBA 3500 ppm: SA:CF/SCBAF/SAF g: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Irrit eyes, resp sys, skin; CNS depres; pulm edema; liver, kidney disease; card arrhy; card arrest	Eye: Skin: Breath: Swallow:	Irr immed Soap flush prompt Resp support Medical attention immed	Skin, liver, kidneys, resp sys, CVS, CNS

ATTACHMENT "B"

MATERIAL SAFETY DATA SHEETS

***ACETONE**
***ACETONE**
***ACETONE**

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS:
GASTON L. PILLORI: (201) 796-7100
AFTER BUSINESS HOURS, HOLIDAYS:
(201) 796-7523
CHEMTREC ASSISTANCE: (800) 429-9300

DATE: 02/27/89
PO NBR: 25-1540/ADD
ACCT: 878660-16
INDEX: 06890450336
CAT NO: A184

THE INFORMATION BELOW IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

SUBSTANCE: ***ACETONE**

CAS-NUMBER 67-64-1

TRADE NAMES/SYNONYMS:

DIMETHYLFORMALDEHYDE, DIMETHYLKETAL, DIMETHYL KETONE, BETA-KETOPROPANE, PROPANONE, 2-PROPANONE, PYROACETIC ETHER, B-KETOPROPANE, RCRA U002, STCC 4908105, UN 1090, A-949, A-40, A-20, A-19, A-946, A-18, A-18-S, A-18-SK, A-11, A-11-S, A-16-P, A-16-S, C3H6O, ACC00140

CHEMICAL FAMILY:
KETONE, ALIPHATIC

MOLECULAR FORMULA: C-H3-C-O-C-H3

MOLECULAR WEIGHT: 58.08

CERCLA RATINGS (SCALE 0-3): HEALTH=1 FIRE=3 REACTIVITY=0 PERSISTENCE=0
NFPRA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: ACETONE

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

ACETONE:

1000 PPM (2400 MG/M3) OSHA TWA
750 PPM (1780 MG/M3) ACGIH TWA; 1000 PPM (2375 MG/M3) ACGIH STEL
250 PPM (590 MG/M3) NIOSH RECOMMENDED 10 HOUR TWA

5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS, VOLATILE LIQUID WITH A CHARACTERISTIC, SWEETISH, FRAGRANT, MINT-LIKE ODOR AND PUNGENT, SWEETISH TASTE.

BOILING POINT: 133 F (56 C) MELTING POINT: -139 F (-95 C)

SPECIFIC GRAVITY: 0.7899 VOLATILITY: 100%

VAPOR PRESSURE: 180 MMHG @ 20 C EVAPORATION RATE: (BUTYL ACETATE=1) 14.4

PH: NEUTRAL IN SOLUTION SOLUBILITY IN WATER: VERY SOLUBLE

ODOR THRESHOLD: 20 PPM VAPOR DENSITY: 2.0

SOLVENT SOLUBILITY: SOLUBLE IN ETHANOL, ETHER, CHLOROFORM, BENZENE, MOST OILS, DIMETHYLFORMAMIDE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

FLASH POINT: -4 F (-20 C) (CC) UPPER EXPLOSIVE LIMIT: 13%

LOWER EXPLOSIVE LIMIT: 2.5% AUTOIGNITION TEMP.: 869 F (465 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR ALCOHOL FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 26).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED. USE FLOODING AMOUNTS OF WATER AS A FOG; SOLID STREAMS MAY BE INEFFECTIVE. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS; KEEP UPWIND. IF FIRE IS UNCONTROLLABLE OR CONTAINERS ARE EXPOSED TO DIRECT FLAME, EVACUATE TO A RADIUS OF 1500 FEET. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

WATER MAY BE INEFFECTIVE (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIALS, EIGHTH EDITION).

ALCOHOL FOAM (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIAL, EIGHTH EDITION).

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101;
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402;
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: 9CFR173.118

TOXICITY

ACETONE:
500 PPM EYE-HUMAN IRRITATION; 395 MG OPEN SKIN-RABBIT MILD IRRITATION; 3950 UG EYE-RABBIT SEVERE IRRITATION; 20 MG/24 HOURS EYE-RABBIT MODERATE IRRITATION; 500 MG/24 HOURS SKIN-RABBIT MILD IRRITATION; 500 PPM INHALATION-HUMAN TCLO; 12000 PPM/4 HOURS INHALATION-MAN TCLO; 10 MG/M3/6 HOURS INHALATION-MAN TCLO; 440 UG/M3/6 MINUTES INHALATION-MAN TCLO; 2857 MG/KG ORAL-MAN LDLO; 1159 MG/KG UNREPORTED-MAN LDLO; 5800 MG/KG ORAL-RAT LDLO; 8 GM/KG ORAL-DOG LDLO; 3000 MG/KG ORAL-MOUSE LDLO; 5340 MG/KG ORAL-RABBIT LDLO; 20 GM/KG SKIN-RABBIT LDLO; 110 GM/M3/1 HOUR INHALATION-MOUSE LDLO; 1297 MG/KG INTRAPERITONEAL-MOUSE LDLO; 8 GM/KG INTRAPERITONEAL-DOG LDLO; 500 MG/KG INTRAPERITONEAL-RAT LDLO; 1576 MG/KG INTRAVENOUS-RABBIT LDLO; 5500 MG/KG INTRAVENOUS-RAT LDLO; 4 GM/KG INTRAVENOUS-MOUSE LDLO; 5000 MG/KG SUBCUTANEOUS-GUINEA PIG LDLO; 5 GM/KG SUBCUTANEOUS-DOG LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS);

CARCINOGEN STATUS: NONE.

ACETONE IS A SKIN, EYE AND MUCOUS MEMBRANE IRRITANT AND CENTRAL NERVOUS SYSTEM DEPRESSANT. THE USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS. PERSONS WITH CHRONIC RESPIRATORY OR SKIN DISEASES MAY BE AT AN INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:

ACETONE:

IRRITANT/NARCOTIC. 20,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- VAPOR CONCENTRATIONS AROUND 1000 PPM MAY CAUSE SLIGHT TRANSIENT IRRITATION OF THE UPPER RESPIRATORY TRACT. EXPOSURE TO 12,000 PPM HAS CAUSED THROAT IRRITATION AND CENTRAL NERVOUS SYSTEM DEPRESSION WITH WEAKNESS OF THE LEGS, HEADACHE, DIZZINESS, DROWSINESS, NAUSEA AND A GENERAL FEELING OF MALAISE. OTHER POSSIBLE EFFECTS FROM EXPOSURE TO HIGH CONCENTRATIONS INCLUDE DRYNESS OF THE MOUTH AND THROAT, INCOORDINATION OF MOTION AND SPEECH, RESTLESSNESS, ANOREXIA, VOMITING, SOMETIMES FOLLOWED BY HEMATEMESIS, HYPOTHERMIA, DYSPNEA, SLOW, IRREGULAR RESPIRATION, SLOW, WEAK PULSE, PROGRESSIVE COLLAPSE WITH STUPOR, AND IN SEVERE CASES, COMA. LIVER DAMAGE MAY BE INDICATED BY HIGH UROBILIN LEVELS AND JAUNDICE. KIDNEY DAMAGE MAY BE INDICATED BY ALBUMIN AND RED AND WHITE BLOOD CELLS IN THE URINE. BLOOD GLUCOSE LEVELS MAY BE AFFECTED AND FATAL KETOSIS IS POSSIBLE.

CHRONIC EXPOSURE- WORKERS EXPOSED TO 500 PPM/6 HOURS/6 DAYS EXPERIENCED MUCOUS MEMBRANE IRRITATION, AN UNPLEASANT SMELL, HEAVY EYES, OVERNIGHT HEADACHE, AND GENERAL WEAKNESS ACCOMPANIED BY HEMATOLOGIC CHANGES. RECOVERY OCCURRED IN SEVERAL DAYS. WORKERS EXPOSED TO 1000 PPM FOR 3 HOURS/DAY FOR 7-15 YEARS REPORTED CHRONIC INFLAMMATION OF THE RESPIRATORY TRACT, STOMACH AND DUODENUM, DIZZINESS, LOSS OF STRENGTH, AND ASTHENIA. DROWSINESS, VERTIGO, SENSATION OF HEAT, AND COUGHING HAVE ALSO BEEN REPORTED FROM CHRONIC EXPOSURE TO LOW CONCENTRATIONS. ANIMAL STUDIES SHOW ADVERSE EFFECTS ON FERTILITY WHEN FEMALES WERE EXPOSED CHRONICALLY DURING PREGNANCY.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

ACETONE:

IRRITANT.

****ACETONE****

PAGE 03 OF 05

ACUTE EXPOSURE- CONTACT WITH THE LIQUID CAUSED MILD IRRITATION IN RABBITS. CELLULAR DAMAGE TO THE OUTER LAYERS OF THE EPITHELIUM WITH MILD EDEMA AND HYPEREMIA HAS BEEN DEMONSTRATED IN HUMANS, BUT WAS READILY REVERSIBLE. SMALL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN.
CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE DERMATITIS WITH DRYING, CRACKING, AND ERYTHEMA DUE TO THE DEFATTING ACTION. THE AMOUNT ABSORBED THROUGH THE SKIN INCREASES DIRECTLY WITH THE FREQUENCY AND EXTENT OF THE EXPOSURE. 2 OF 3 GUINEA PIGS EXPOSED BY SKIN CONTACT FOR 3 WEEKS DEVELOPED CATARACTS BY THE END OF THREE MONTHS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

ACETONE:

IRRITANT.

ACUTE EXPOSURE- IN HUMANS, VAPORS PRODUCE ONLY SLIGHT IRRITATION WHEN THE CONCENTRATION IS AT OR BELOW 1000 PPM. HOWEVER, HIGH VAPOR CONCENTRATIONS HAVE CAUSED CORNEAL EPITHELIAL AND CONJUNCTIVAL INJURY IN ANIMALS. LIQUID SPLASHED IN HUMAN EYES CAUSES AN IMMEDIATE STINGING SENSATION AND, IF WASHED PROMPTLY, DAMAGE ONLY TO THE CORNEAL EPITHELIUM CHARACTERIZED BY MICROSCOPIC GRAY DOTS AND A FOREIGN BODY SENSATION, WHICH HEALS COMPLETELY IN 1-2 DAYS.

CHRONIC EXPOSURE- PROLONGED OR REPEATED EXPOSURE TO THE VAPORS MAY CAUSE IRRITATION OR CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE. OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

ACETONE:

NARCOTIC.

ACUTE EXPOSURE- MAY CAUSE A FRUITY ODOR OF THE BREATH AND MUCOUS MEMBRANE AND GASTROENTERIC IRRITATION. IN ACUTE CASES, A LATENT PERIOD MAY BE FOLLOWED BY RESTLESSNESS AND VOMITING PROCEEDING TO HEMATEMESIS AND PROGRESSIVE COLLAPSE WITH STUPOR. HEPATORENAL LESIONS HAVE BEEN REPORTED. THE BLOOD GLUCOSE LEVEL MAY BE AFFECTED AND KETOSIS MAY BE FATAL. 10-20 MILLILITERS HAVE BEEN TOLERATED WITHOUT ILL EFFECTS. 200 MILLILITERS HAVE CAUSED STUPOR WITHIN A HALF HOUR, FLUSHED CHEEKS, SHALLOW RESPIRATION, AND COMA WHICH LASTED FOR 12 HOURS. RENAL GLUCOSURIA PERSISTED FOR 5 MONTHS.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- IF VICTIM IS CONSCIOUS, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER, AND INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. GET MEDICAL ATTENTION IMMEDIATELY.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

ACETONE:

ACIDS: INCOMPATIBLE.

AMINES (ALIPHATIC): INCOMPATIBLE.

BROMINE: VIOLENT REACTION WITH EXCESS AMOUNTS OF BROMINE.

BROMINE TRIFLUORIDE: EXPLOSION ON CONTACT.

BROMOFORM: VIOLENT REACTION IN PRESENCE OF BASES (E.G. POTASSIUM HYDROXIDE).

CHLOROFORM: VIOLENT REACTION IN PRESENCE OF A BASE.

CHROMIUM TRIOXIDE: IGNITION ON CONTACT AT AMBIENT TEMPERATURE.

CHROMYL CHLORIDE: INCANDESCENT REACTION.

DIOXYGEN DIFLUORIDE + SOLID CARBON DIOXIDE: EXPLOSION AT -78 C.

HEXACHLOROMELAMINE: POSSIBLE EXPLOSION.

HYDROGEN PEROXIDE: EXPLOSION.

NITRIC ACID: IGNITION.

NITRIC + ACETIC ACID MIXTURE: POSSIBLE EXPLOSION.

NITRIC + SULFURIC ACID MIXTURE: VIOLENT OXIDATION.

NITROSYL CHLORIDE: EXPLOSIVE REACTION.

NITROSYL PERCHLORATE: IGNITION AND EXPLOSION.

NITRYL PERCHLORATE: IGNITION AND EXPLOSION.

OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.

PERMONOSULFURIC ACID: EXPLOSION.

PLASTICS: INCOMPATIBLE.

PLATINUM + NITROSYL CHLORIDE: POSSIBLE EXPLOSION.

POTASSIUM-TERT-BUTOXIDE: IGNITION.

RAYON: INCOMPATIBLE.

SODIUM HYPOBROMITE: EXPLOSION.

SODIUM HYPOIODITE: POSSIBLE EXPLOSION.

SULFUR DICHLORIDE: VIOLENT REACTION.

SULFURIC ACID AND POTASSIUM BICHROMATE: IGNITION.

THIODIGLYCOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.

THIOTRIAZYL PERCHLORATE: POSSIBLE EXPLOSION.

1,1,1-TRICHLOROETHANE: EXOTHERMIC CONDENSATION BY A BASIC CATALYST.

TRICHLOROMELAMINE: POSSIBLE EXPLOSION.

SEE ALSO KETONES.

KETONES:

ACETALDEHYDE: VIOLENT CONDENSATION REACTION.

NITRIC ACID + HYDROGEN PEROXIDE: FORMATION OF EXPLOSIVE PRODUCT.

PERCHLORIC ACID: VIOLENT DECOMPOSITION.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

XXSTORAGEXX

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

XXDISPOSALXX

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE. 40CFR 262. EPA HAZARDOUS WASTE NUMBER U002.

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUN-OFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY, ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 5000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS, OR DEPARTMENT OF LABOR, 29CFR1910 SUBPART 2.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

1000 PPM- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY POWERED AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY SUPPLIED-AIR RESPIRATOR.
ANY SELF-CONTAINED BREATHING APPARATUS.

6250 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

12,500 PPM- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

20,000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ACETONE PAGE 05 OF 05
SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE
DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND
OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY
SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER
POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT
TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS
SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT
EYE CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

AUTHORIZED - FISHER SCIENTIFIC GROUP, INC.
CREATION DATE: 09/06/84 REVISION DATE: 11/09/88

-ADDITIONAL INFORMATION-
THE INFORMATION BELOW IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST
INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF
MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO
SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS
SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE
INFORMATION FOR THEIR PARTICULAR PURPOSES.

Material Safety Data Sheet

Required under USOL Safety and Health Regulations
for Shipyard Employment (29 CFR 1915)

DEC 07 1990
SERVICES

ALCONOX POWDER DETERGENT
U.S. Department of Labor
Occupational Safety and Health Administration
04-322-4



OSHA No 1018-0074
Expiration Date 06/30/86

PREPARED 1/2/85

Section I

Manufacturer's Name

ALCONOX, INC.

Emergency Telephone Number

(212) 473-1300

Address (Number, Street, City, State, and ZIP Code)

215 PARK AVENUE SOUTH

Chemical Name
and Synonyms

N.A.

Trade Name
and Synonyms

ALCONOX

NEW YORK, N.Y. 10003

Chemical
Family

ANIONIC DETERGENT

Formula

N.A.

Section II - Hazardous Ingredients

Paints, Preservatives, and Solvents

% TLV (Units) Alloys and Metallic Coatings

% TLV (Units)

Pigments

NONE

Base Metal

NONE

Catalyst

NONE

Alloys

NONE

Vehicle

NONE

Metallic Coatings

NONE

Solvents

NONE

Filler Metal

NONE

Additives

NONE

Others

NONE

Others

NONE

Hazardous Mixtures of Other Liquids, Solids or Gases

NONE

% TLV (Units)

Section III - Physical Data

Boiling Point (°F)

N.A.

Specific Gravity (H₂O=1)

N.A.

Vapor Pressure (mm Hg)

N.A.

Percent Volatile by Volume (%)

N.A.

Vapor Density (Air=1)

N.A.

Evaporation Rate

N.A.

Solubility in Water

APPRECIABLE

Appearance and Odor

WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)

NONE

Flammable Limits

N.A.

LEL

N.A.

UEL

N.A.

Extinguishing Media

WATER, CO₂, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards

.....

Effects of Overexposure

PROLONGED EXPOSURE TO DUST MAY IRRITATE MUCOUS MEMBRANES

Emergency First Aid Procedures

EYES - FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH PLENTY OF WATER. INGESTION - DRINK LARGE QUANTITIES OF WATER TO DILUTE MATERIAL. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VI - Reactivity Data

Stability	Unstable	Conditions to Avoid
	Stable X	NONE

Incompatibility (Materials to Avoid)

AVOID STRONG ACIDS

Hazardous Decomposition Products

MAY RELEASE CO₂ GAS ON BURNING

Hazardous Polymerization	May Occur	Conditions to Avoid
	Will Not Occur X	NONE

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled

MATERIAL FOAMS PROFUSELY, SHOVEL AND RECOVER

AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method

SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT

Section VIII - Special Protection Information

Suggested Protective Clothing Type:

DUST MASK

Ventilation	Local Exhaust	Normal	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves

USEFUL - NOT REQUIRED

Eye Protection

USEFUL - NOT REQUIRED

Other Protective Equipment

NOT REQUIRED

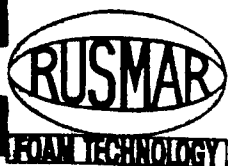
Section IX - Special Precautions

Instructions for Handling and Storage

SHOULD BE STORED IN A DRY AREA TO PREVENT CAKING

Other Precautions

NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.



MATERIAL SAFETY DATA SHEET

AC-645

SECTION I: GENERAL INFORMATION

Manufacturer's Name: RUSMAR INCORPORATED
Manufacturer's Address: 216 Garfield Avenue
West Chester, PA 19380
Manufacturer's Phone No.: 215-436-4314
Chemical Family: Aqueous anionic surfactant mixture
Trade Name: RUSMAR AC-645

SECTION II: HAZARDOUS INGREDIENTS

Paints, Preservatives, and Solvents -- None
Alloys and Metallic Coatings -- None
Hazardous Mixtures and Other Materials -- None

SECTION III: PHYSICAL DATA

Boiling Point: 100° C
Vapor Pressure: 25mm Hg at 25° C
Vapor Density (Air = 1): N/A
Water Solubility: Complete
Appearance/Odor: Translucent, white, milk-like, odorless, viscous liquid
Specific Gravity: 1.01 to 1.06
% Volatile, By Volume: None
Evaporation Rate: N/A

SECTION IV: FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method): Nonflammable
Flammable Limits: N/A
Extinguishing Media: N/A
Special Fire Fighting Procedures: None
Unusual Fire and/or Explosion Hazards: None

SECTION V: HEALTH HAZARD DATA

Threshold Limit Value: Not Determined

Effects of Overexposure: This material is not expected to present an inhalation or ingestion hazard. It may cause an eye or skin irritation upon direct contact.

Emergency and First Aid Procedures: Wash thoroughly with clean water.

SECTION VI: REACTIVITY DATA

Material is stable

No material incompatibility

Hazardous Decomposition Products: Low levels of sulfur oxides on combustion.

Polymerization will not occur

SECTION VII: SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled: If spilled indoors on a hard surface, the spill area may be slippery and should be thoroughly washed with water. Contain spill and absorb material with dirt or other appropriate absorbent.

Waste Disposal Method: This material is completely biodegradable and can be disposed of in a sanitary landfill according to local regulations.

SECTION VIII: SPECIAL PROTECTION INFORMATION

Respiratory Protection: None required for normal operations

Ventilation: No special requirements

Protective Gloves: Not required, but recommended.

Eye Protection: Not required, but recommended.

Other Protective Equipment: None

SECTION IX: SPECIAL PRECAUTIONS

Storing/Handling Precautions: Avoid excessive heat. Material will freeze, but thawing will not cause changes in the product.

Other Precautions: None

43660 -02
EFFECTIVE: 09/10/86

NITRIC ACID

PAGE:
ISSUED: 09/12/86

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: NITRIC ACID
FORMULA: HNO₃
FORMULA WT: 63.01
CAS NO.: 7597-37-2
NIOSH/RTCS NO.: 405775000
COMMON SYNONYMS: HYDROGEN NITRATE; AZOTIC ACID
PRODUCT CODES: 4801, 9505, 9502, 9598, 9606, 9601, 9597, 9500, 5113, 9615, 5371

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 3 (POISON)
FLAMMABILITY - 0
REACTIVITY - 3 (OXIDIZER)
CONTACT - 4 (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER

STRONG OXIDIZER - CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE
LIQUID AND VAPOR CAUSE SEVERE BURNS - MAY BE FATAL IF SWALLOWED
HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY

SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS

KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS. DO NOT
STORE NEAR COMBUSTIBLE MATERIALS. DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
DO NOT BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE
VENTILATION. IN CASE OF FIRE, USE WATER SPRAY, ALCOHOL FOAM, DRY CHEMICAL, OR
CARBON DIOXIDE. FLUSH SPILL AREA WITH WATERSPRAY.

SECTION II - HAZARDOUS COMPONENTS

COMPONENT	%	CAS
NITRIC ACID	65-75	7697-37

SECTION III - PHYSICAL DATA

BOILING POINT: 121 C (250 F) VAPOR PRESSURE(MM HG):
MELTING POINT: -42 C (-44 F) VAPOR DENSITY(AIR=1):
SPECIFIC GRAVITY: 1.41 EVAPORATION RATE: N/A
(H₂O=1) (BUTYL ACETATE=1)

CONTINUED ON PAGE: 2

V3660 -02

NITRIC ACID

PAGE:

EFFECTIVE: 09/10/86

ISSUED: 09/12/86

SECTION III - PHYSICAL DATA (CONTINUED)

SOLUBILITY(H₂O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME: 100

APPEARANCE & ODOR: COLORLESS LIQUID, WITH CHOKING ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: N/A

MFPA 704M RATING: 3-0-0 OXY

FLAMMABLE LIMITS: UPPER - N/A %

LOWER - N/A %

FIRE EXTINGUISHING MEDIA

USE WATER SPRAY.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL; DO NOT GET WATER INSIDE CONTAINERS

UNUSUAL FIRE & EXPLOSION HAZARDS

STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

TOXIC GASES PRODUCED

NITROGEN OXIDES, HYDROGEN GAS

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 5 MG/M³ (2 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 10 MG/M³ (4 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 5 MG/M³ (2 PPM)

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE: INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, LIGHTEADEDNESS OR HEADACHE. INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE RESPIRATORY SYSTEM. INHALATION OF VAPORS MAY CAUSE COUGHING, CHEST PAIN, DIFFICULTY BREATHING, OR UNCONSCIOUSNESS. CONTACT WITH LIQUID OR VAPOR MAY CAUSE SEVERE IRRITATION OR BURNS OF THE SKIN, EYES, AND MUCOUS MEMBRANES. INGESTION MAY CAUSE SEVERE BURNS TO MOUTH, THROAT, & STOMACH. MAY HAVE ADVERSE EFFECT ON KIDNEY FUNCTION & MAY BE FATAL. INGESTION IS HARMFUL & MAY BE FATAL

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NONE IDENTIFIED.
ROUTES OF ENTRY: INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT.

EMERGENCY & FIRST AID PROCEDURES: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE WATER, MILK OR MILK OF MAGNESIA. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

CONTINUED ON PAGE: 3

13660 -02
EFFECTIVE: 09/10/86

NITRIC ACID

PAS
ISSUED: 09/1

=====

SECTION VI - REACTIVITY DATA

=====

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, LIGHT, MOISTURE

INCOMPATIBLES: STRONG BASES, COMBUSTIBLE MATERIALS,
STRONG REDUCING AGENTS, ALKALIES, MOST COMMON METAL
ORGANIC MATERIALS, ALCOHOLS, CARBIDE

DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN, HYDROGEN

=====

SECTION VII - SPILL AND DISPOSAL PROCEDURES

=====

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.
LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL
SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN
DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.
KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL.

J. T. SAKER NEUTRASORB(R) OR NEUTRASOL(R) "LOW NA+" ACID NEUTRALIZERS
ARE RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: 0002 (CORROSIVE WASTE)

=====

SECTION VIII - PROTECTIVE EQUIPMENT

=====

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET
TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE
CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP
TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH
ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL,
A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM,
PROTECTIVE SUIT, ACID-RESISTANT GLOVES ARE
RECOMMENDED.

=====

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

=====

SAF-T-DATA(TM) STORAGE COLOR CODE: YELLOW

SPECIAL PRECAUTIONS
KEEP CONTAINER TIGHTLY CLOSED. STORE SEPARATELY AND AWAY FROM FLAMMABLES

CONTINUED ON PAGE: 4

ATTACHMENT "C"

SAFETY PROCEDURES/FIELD OPS

(A copy of the WESTON Safety Officer Field Manual will be kept on site)

ATTACHMENT "C"

SAFETY PROCEDURES/FIELD OPS

(A copy of the WESTON Safety Officer Field Manual will be kept on site)

APPENDIX E

LIST OF APPLICABLE REMEDIAL STANDARDS

L. E. CARPENTER SOIL REMEDIATION GOALS

Contaminant	Non Residential Direct Contact Soil Cleanup Criteria (mg/kg)	Impact to Ground Water Soil Cleanup Criteria (mg/kg)
Organic Compounds		
Aroclor 1254 (PCB)	2.0*	100
Bis(2-ethylhexyl)phthalate	210	100
Di-n-butyl phthalate	10,000	100
Ethylbenzene	1000	100
Toluene	1000	500
Xylene (total)	1000	10
Inorganic Compounds		
Antimony	340	340
Arsenic	20	*
Lead	600	*

* Based upon the enactment of a Declaration of Environmental Restriction on the Wharton Enterprises property.

GROUND WATER DISCHARGE CRITERIA
AND
GROUND WATER QUALITY STANDARD
L. E. CARPENTER SITE

COMPOUND	NEW JERSEY GROUND WATER QUALITY STANDARDS* (ppb)	DISCHARGE CRITERIA (ppb)
<i>Organic Compounds</i>		
Ethylbenzene	700	350
Toluene	1000	500
Xylenes (total)	40	20
Bis(2ethylhexyl)phthalate	30	30
n-Decane	100**	50
Di-n-octylphthalate	100	50
1-Ethyl-3-methylbenzene	100**	50
n-Nonane	100**	50
1,2,3-Trimethylbenzene	100**	50
1,2,4-Trimethylbenzene	100**	50
1,3,5-Trimethylbenzene	100**	50
Chlorobenzene	4	2
Chloromethane	30	15
1,1-Dichloroethane	70	35
1,1-Dichloroethene	2	2
cis-1,2-Dichloroethene	10	5
trans-1,2-Dichloroethene	100	50
Heptane	100**	50
Tetrachloroethene	100	1
1,1,1-Trichloroethane	30	15

Trichloroethene	1	1
1,1,2 Trichloro-1,2,2-trifluoroethane	20,000 ^{***}	10,000
Carbon Tetrachloride	2	2
Acetone	700	350
Methyl Ethyl Ketone [2-Butanone]	300	150
Butylbenzylphthalate	100	50
n-Butylbenzene	100 ^{**}	50
1,2-Diethylbenzene	100 ^{**}	50
Diethylphthalate	5000	2500
Di-n-butylphthalate	900	450
Isopropylbenzene [Cumene]	300 ^{***}	150
Naphthalene	30 ^{***}	15
N-Nitrosodiphenylamine	20	20
1,2,3,4-Tetramethylbenzene	100	50
Phenol	4000	2000
2-Nitrophenol	100 ^{**}	50
2,4 Dimethylphenol	100	50
<i>Inorganic Compounds</i>		
Beryllium	20	20
Cadmium	4	2
Chromium (total)	100	50
Copper	1000	500
Lead	10	10
Mercury	2	1
Nickel	100	50

Selenium	50	25
Silver	40	20
Zinc	5000	2720
Antimony	20	20
Arsenic	8	8

* New Jersey Class II Ground Water Quality Standards, N.J.A.C. 7:9-6 et seq.
 ** Interim Generic Criteria pursuant to NJAC 7:9-6.7(c)6
 *** Interim Specific Criteria pursuant to NJAC 7:9-6.7(c)

APPENDIX F

IDENTIFICATION OF REQUIRED PERMITS

LIST OF PERMITS REQUIRED FOR PHASE I REMEDIAL ACTION

L.E. CARPENTER AND COMPANY, WHARTON, NEW JERSEY

Statewide General Freshwater Wetlands Permit - General Permit No. 4

Freshwater Wetlands Transition Area Waiver

Stream Encroachment

Well Drilling

APPENDIX G
WETLAND MITIGATION PLAN

WILL BE SUBMITTED UNDER SEPARATE COVER

APPENDIX H

SOIL EROSION AND SEDIMENT CONTROL PLAN

WILL BE SUBMITTED UNDER SEPARATE COVER

APPENDIX I

PILOT SCALE INFILTRATION GALLERY DESIGN

PILOT SCALE INFILTRATION GALLERY DESIGN

BACKGROUND

A pilot-scale infiltration system will be located at the L.E. Carpenter site as indicated in Figure 1. Groundwater from the pump tests that will be conducted at the site will be collected in Frac tanks and infiltrated into the shallow zone via the pilot-scale infiltration system. The discharge of groundwater to the pilot-scale infiltration system will serve as a test to estimate the amount of water that can be discharged at the site using a full-scale infiltration system. Data from this test will be used to develop design data for a full-scale infiltration system for disposal of the treated groundwater generated by the final remedy for the site.

The design basis, sizing, and a description (including sketches) of the pilot-scale infiltration system are provided below. During this test, the pilot-scale infiltration system will be gravity-fed, and the rate of infiltration will be dependent upon the capabilities of the underlying soils. The infiltration capabilities of the underlying soils will be established during the test.

SYSTEM DESIGN

The pilot-scale infiltration system is approximately 1,400 square feet in area, as indicated in Figure 2. The system is designed in accordance with the New Jersey construction standards for subsurface sewage disposal systems (N.J.A.C. 7:9A-7.2). However, the system will discharge only the treated groundwater and will not discharge sewage. The system will consist of a 3-inch diameter high-density polyethylene (HDPE) manifold, running along the western side of the infiltration area at a slope of 1/4-inch per foot, with 3-inch diameter HDPE laterals spaced 6-feet on-center, as indicated in Figure 2. Groundwater will be discharged directly to the system from the Frac tank, and the water will infiltrate across the infiltration area via the perforated, 3-inch diameter laterals. A cross-sectional detail of the pilot-scale infiltration system is provided in Figure 3. The laterals will be perforated every 2-feet with a 1/4-inch diameter hole along the bottom of the lateral. The laterals will be set in natural or man-made fine aggregate which meets the specifications listed in Table 1.

The specific requirements of the infiltration system are listed in Table 1. The bottom of the infiltration system will be level and the entire system, top, sides, and bottom, will be wrapped in an approved geotextile material (i.e.; Mirafi 140N or Typar 3151). A minimum of 12-inches of soil cover will be placed on top of the system.

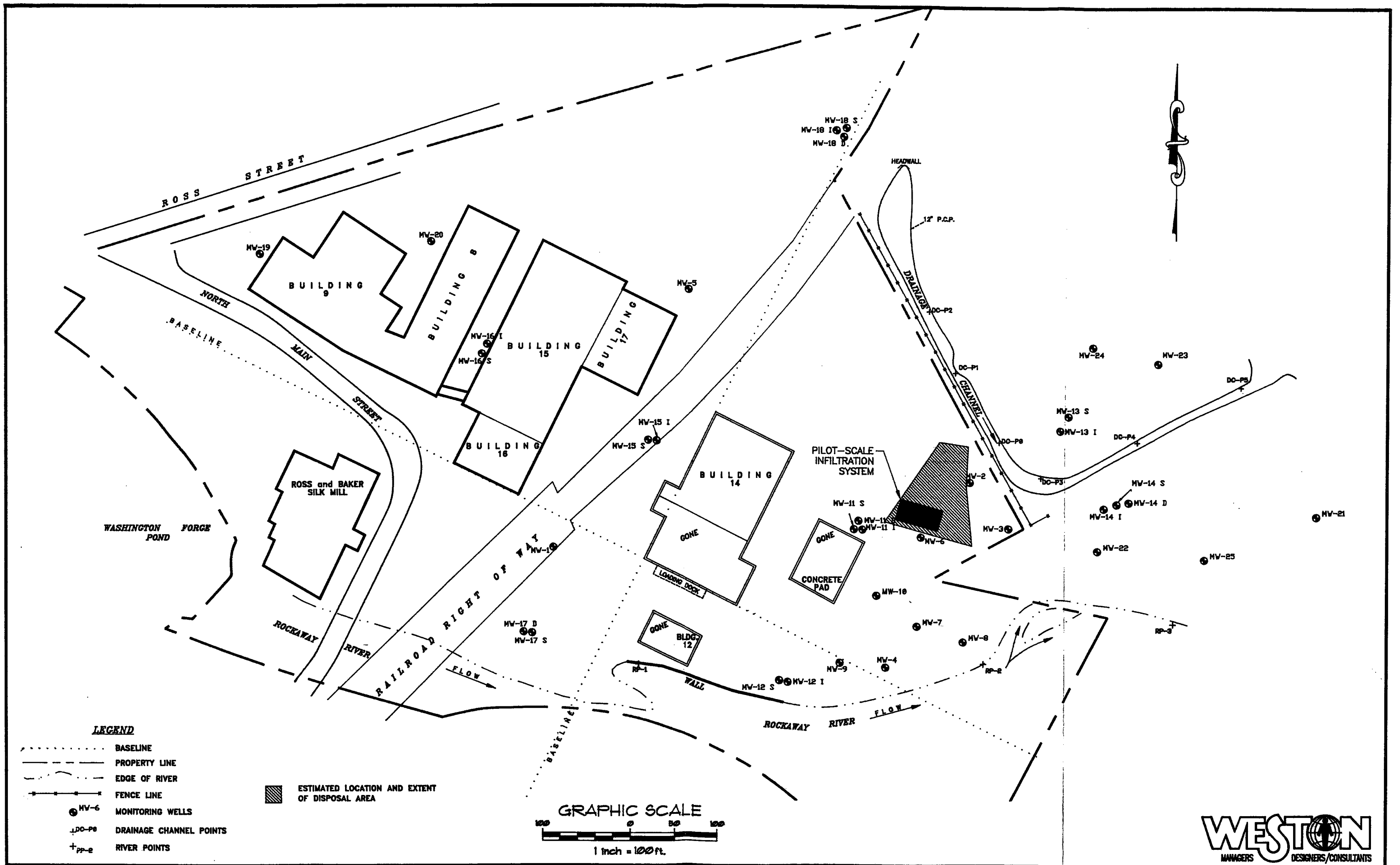


FIGURE 1 LOCATION OF PILOT-SCALE INFILTRATION SYSTEM

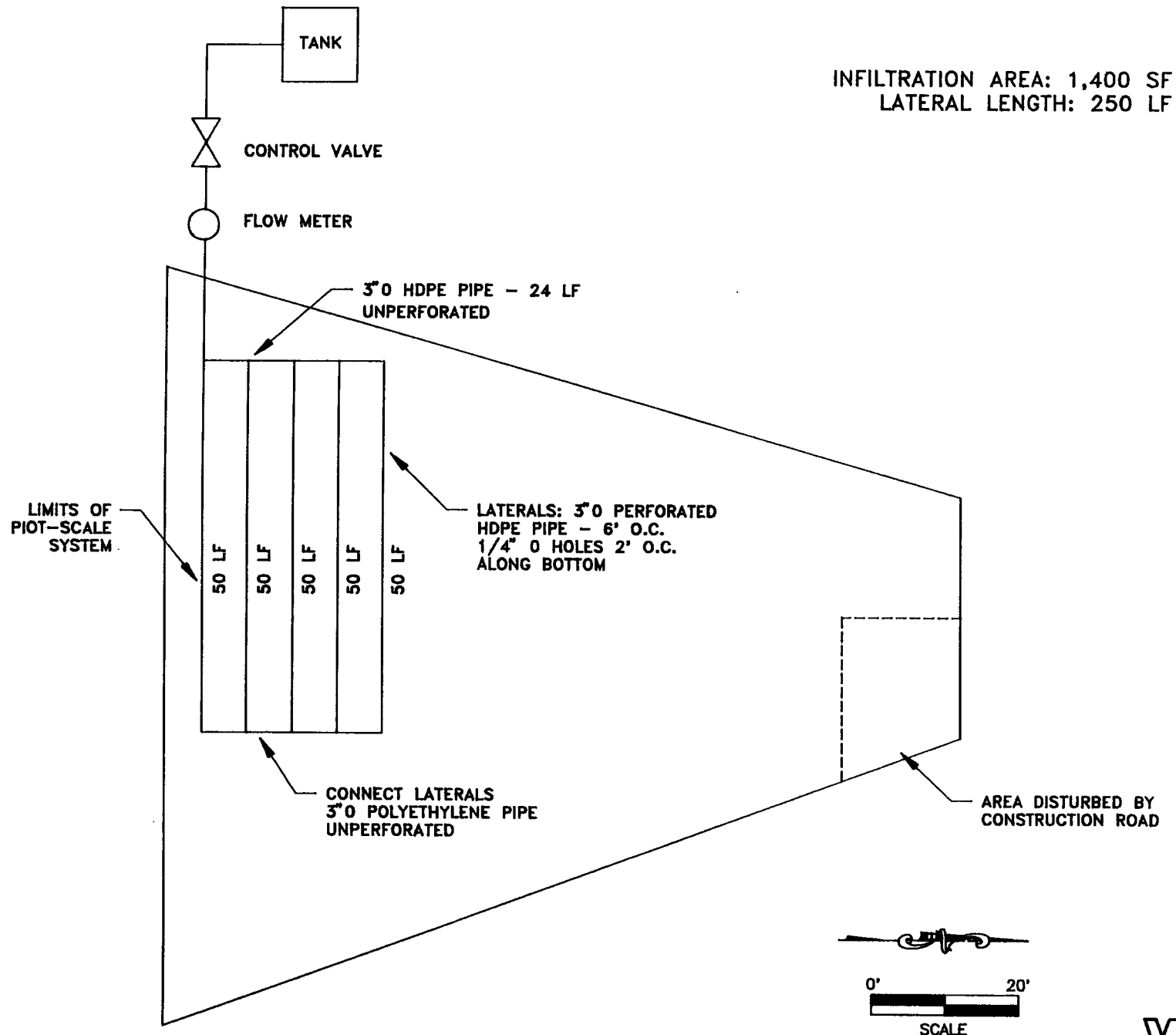
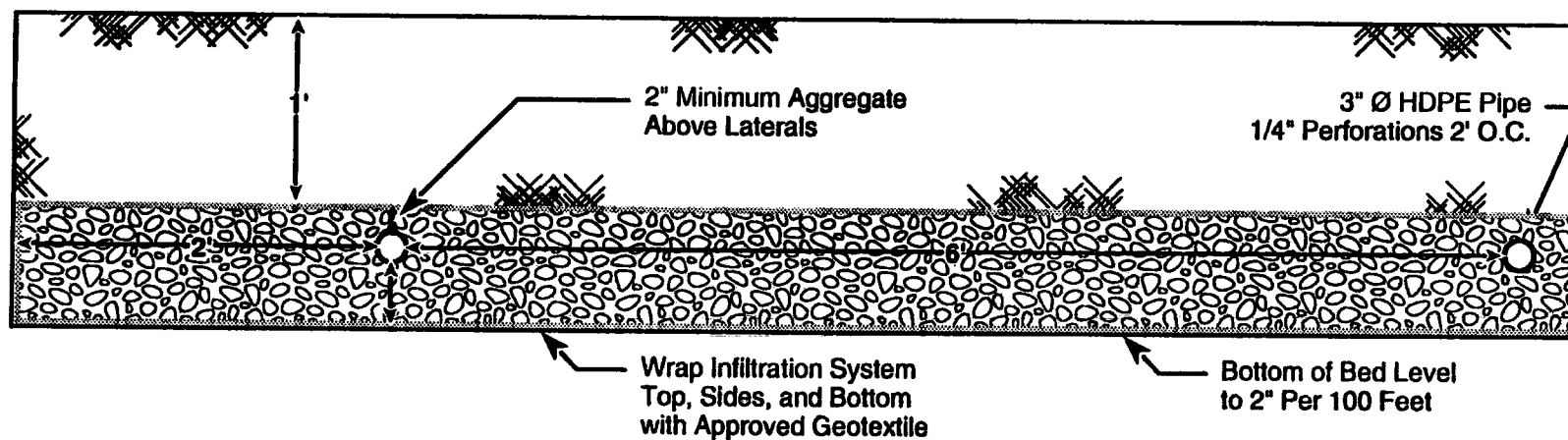


FIGURE 2 PILOT-SCALE INFILTRATION SYSTEM SCHEMATIC



- 2' from Sidewall to Lateral
- Laterals Spaced 6' O.C.
- Minimum 6" Aggregate Below Laterals
- Minimum 2" Aggregate Above Laterals
- Minimum 1' Cover Above Aggregate

0 1/2 1
Scale In Feet

94P-5643

9/22/94

FIGURE 3 DETAIL OF INFILTRATION SYSTEM

TABLE 1

SYSTEM SPECIFICATIONS

- Bottom of System
- Aggregate under laterals
- Aggregate above laterals
- Geotextile
- Depth of aggregate
- Manifold
- Laterals
- Earth cover
- Aggregate material - according to the following requirements:
- Level to +/- 2-inches per 100-feet
- Minimum 6 inches
- Minimum 2 inches
- Top, bottom, and sides of system
- Uniform across system
- 3-inch diameter high-density polyethylene pipe (HDPE), smooth-walled
- Sloped at 1/4" per foot
- 3-inch diameter perforated, HDPE pipe, smooth-walled
- 1/4" diameter holes spaced 2 feet O.C. along bottom of pipe
- Sloped at 4" per 100 feet
- Spaced 6 feet O.C.
- Minimum 2 feet from sidewalls of system
- Minimum 12 inches

<u>Sieve Size</u>	<u>Maximum Percentage Passing Sieve</u>
3/8-inch	100%
No. 4	90-100%
No. 30	20-60%
No. 200	0.0-15%

SYSTEM OPERATION AND CAPACITY

The rate of flow from the Frac tank to the system will be regulated by a control valve, and the rate of flow estimated by a flow meter. During the pilot-scale study, the system capacity will be established by "flooding" the system to its estimated capacity of approximately 2,750 gallons, and measuring the additional volume of flow the system is capable of receiving over a given time period.

The total storage capacity of the system, including the aggregate storage capacity and the laterals, manifold, and connector pipes, is estimated to be approximately 2,750 gallons (380 cubic feet). It is anticipated that infiltration rates will average at least 1-inch per hour based upon the upper soils consisting of a clay/silt mixture. However, the actual long-term capacity of the system will be determined during operation of the pilot-scale system.